U. S. DEPARTMENT OF AGRICULTURE.

Report No. 69.

PROGRESS

OF THE

BEET-SUGAR INDUSTRY

IN THE

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REPORT OF SPECIAL AGENT

CHARLES F. SAYLOR.

LETTER OF SUBMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SPECIAL AGENT,
Washington, D. C., April 15, 1901.

SIR: I submit herewith, for your inspection and approval, my report for 1900 as special agent for the investigation of the sugar industry. It includes the results of my own observations and investigations, and a considerable mass of information pertinent to the subject collected from various reliable sources.

CHAS. F. SAYLOR, *Special Agent.*

HON. JAMES WILSON,
Secretary of Agriculture.

INTRODUCTION.

This report follows the same general lines as its predecessors. It is prepared in what is believed to be the best form for the general reading public. Technical matter and scientific style are avoided as far as possible. Due attention has been paid to criticisms and comments of the press on previous reports; also to criticisms and suggestions received through correspondence and otherwise.

The instruction of all classes who are or may become interested in the beet-sugar industry has been the object kept always in view. As the interest in this industry is rapidly spreading, and thousands of persons will read this report who never saw those of previous years, it has seemed absolutely necessary to devote some attention to topics already treated somewhat fully in my previous reports. Hence no apology is deemed necessary for repetition.

Those most interested in the success of this industry in the United States are certainly to be congratulated on the rapid and substantial

progress it has made. Only a few years ago our people were entirely unacquainted with any phase of the sugar industry except the consumption of the product. Capitalists knew nothing of its manufacture except that large capital was necessary to start the industry. The farmers had to be educated in a new branch of agricultural production. The capitalists had to learn all the conditions necessary to the success of a factory. The broad domain of the United States had to be investigated and the conditions of localities tested. Along these lines a vast amount of preliminary work has been done. The beet-sugar belt has been successfully delimited, and in many localities within that belt the industry has successfully passed beyond the experimental stage.

Primary work was necessarily the first requirement. The Department of Agriculture, working in conjunction with the State experiment stations, has been diligently experimenting and solving the agricultural questions that entered into the beet-sugar problem. The kinds of soil, the conditions of climate, the sections of country, the cost and profits of production, the direct and indirect benefits to the farming industry are subjects that have been carefully studied, and the results have been published. The secular and agricultural press, and writers and lecturers on agricultural subjects have all aided materially in this work.

Capitalists have investigated the statistics of those countries of Europe that have had this industry established for some time. They are becoming much better posted on the questions involved, such as the amount of capital required, the profits of manufacture, and the conditions necessary in establishing a factory at any given point. This primary education is now a part of the general information of the country.

There has been a marked tendency during the past year toward a crystallization of ideas into something tangible and peculiar to our own conditions, so that a less effort will be followed by a greater accomplishment than formerly, and the effort itself has been greatly stimulated. We can expect, as the years roll on, to see this industry safely established and making sure progress.

While the record of conditions that obtain in farming localities is being made up, the farmers themselves are gaining information as to the culture and uses of the sugar beet and its cost of production. They are learning the value of the crop for stock-feeding purposes. No well-regulated farm should be without facilities for storing up a good supply of these roots for feeding purposes. They are a valuable element in the food ration of the dairy cow or the fattening lamb or steer. They are excellent for brood animals. They can be easily prepared as cooked food. In any manner fed they are easily digestible. They are very desirable as a food ration in which the cereals enter to

a considerable extent. They seem to mitigate the evil effects of feeding hogs on an exclusively corn ration. All these facts are coming home to the farmers. It can readily be observed that, at this stage of the industry, efforts put forth by the Department of Agriculture, the State experiment stations, and others who are competent to give information are very much more effective.

The public mind is much better prepared to receive facts and literature bearing on this industry than it was three or four years ago. Outside of the actual accomplishment in the way of establishing factories and developing information incident to sugar-beet growing in this country the receptive mood of the people would in itself repay the cost of the effort that has been put forth. Public interest manifests itself in many ways. One scarcely meets a farmer or business man these days who has not given more or less attention to the results of sugar-beet experiments that have been carried on, and they generally express faith in the success of beet-sugar enterprises.

While capitalists as well as farmers manifest a deep interest in the future of the sugar industry, they have been no doubt somewhat restrained by the uncertainty attending the future of our new island dependencies, which are themselves largely sugar producers. On this subject little need be said. The writer speaks not only as the result of careful consideration of all the available data on the sugar industry in these dependencies, but as the result of personal visits to Hawaii and Porto Rico, and has no hesitation in asserting that were the opportunities for developing this industry in these new territories to be extended to their utmost capacity there would be nothing in this to discourage our domestic sugar producers. For years our domestic sugar consumption has been increasing even more rapidly than the increase of population, until during the past fiscal year our imports of sugar attained the enormous total of nearly 2,000,000 tons. For generations to come, then, it will be necessary for the people of the United States to import considerable sugar over and above what we are likely to produce, and of this importation the combined production of our new island dependencies will not do more than supply a part, and let us hope a large part.

Seed Distribution.

The distribution of seeds from both the Department of Agriculture and the State experiment stations has become more systematic. The Department has usually followed the rule of sending out seeds in bulk to some individual or center, where the parceling out to individuals has been accomplished in a systematic manner. The State experiment stations followed a system of making up their own lists of farmers for distribution of seeds. These names were selected from those known to be successful and attentive to farming interests.

During the past year the system of seed distribution has been improved and made more effective. Most of the State experiment stations have been stimulating local organizations, known as "Sugar-beet growers' associations." An association of this kind represents a certain limited district or territory. A sufficient number of plats of ground are laid out to test the various soils of that section. The farmers owning these plats are furnished the beet seed and given special instruction on sugar-beet culture. In some cases the farmers give the use of the plats of ground and the association hires a competent superintendent and employs the laborers needed in the growing of the beets on these plats. This method is very desirable, but its success depends upon the ability of the association to collect funds for defraying the expenses. This method makes the data concerning the planting, cultivation, harvesting, and disposal of the beet crop easily obtainable and at the same time accurate. Thus the methods of investigating this industry are becoming more definite and systematic. The facts are compiled and published and become a part of the history of the beet-sugar industry. Almost every farming section in the United States where the success of sugar-beet culture seems at all probable has been investigated, tested by actual experiments, and the results have been put on record.

Consumption of Sugar.

The consumption of sugar in this country is increasing very fast. The development of the arts and manufactures constantly calls for an increased amount of sugar. Outside of the demand which comes from the use of sugar as an article of diet, this increase in consumption is growing with our industries.

The use of sugar, except for apothecary purposes, is quite modern when we consider the generations of the human family. Queen Elizabeth was one of the first practical patrons of sugar. She ordered it regularly on her table, both as an article of diet and for the purpose of calling the attention of her people to its utility. In the comparatively short time which has since elapsed, what appeared as a royal caprice has become an established custom of the people in all civilized nations. Hardly any other article of food deserves more than sugar to be recognized as a staple item of diet. It is comparatively recent when Napoleon asked his scientists to name a source and a process through which France would be able to furnish her own supply of sugar when she was blockaded by hostile armies. In that short time has been evolved the processes, the immense output of products, the capitalization, and the vast employment of labor that has given the sugar beet the place in the world's economy which it occupies to-day.

In this country there is scarcely an individual who can not be classed as a consumer, regularly and directly, of this product. It is only nec-

essary to study the constantly widening use to which sugar is put in order to understand the wonderful increase in its consumption. Even as an article of diet the amount of sugar consumed per capita has grown greatly in the last half century and quite perceptibly in the last quarter. The prime reasons for this increase are (1) the fact that the people are becoming more able to purchase the good things of life; (2) the gradual cheapening of sugar. Many things that were formerly luxuries are now real necessities. In the homes of the people sugar was first on the list to be affected by the demand for a better style of living. As the years roll on this increase will be more or less constant.

New theories and discoveries are constantly increasing the consumption of sugar. The United States War Department is shipping over 37,000 pounds of candy monthly for the use of the soldiers in the Philippines, who are thus encouraged to purchase it on the theory that a certain amount of saccharine matter is desirable as a supplement to the regular ration. Similar experiments have been tried on the different armies in Europe, the results of which have been favorably reported. Many physicians and scientists indorse the use of sugar as a regular part of army rations.

There has been a great increase in the use of sugar in the manufacture of druggists' supplies, in the formation of tinctures and sirups of all kinds. In the confectioners' art we find an industry that has grown beyond all comparison in all sections of the United States, and with the growth of this industry has grown the demand for the raw products, chief among which is sugar.

The industry, however, that has entered most into the demand for sugar and has been most constant in its growth is that of preserving fruits. The preserving industries are among the most important in several of the States. As new facilities are acquired for opening up and bringing into use new agricultural lands—such, for instance, as irrigation—new fruit industries are constantly being established, the products of which must find a market. For the preparation of the fruits for market canneries have been established, and in this way preserved products—such as jellies, preserves, jams, and the like—are constantly being pushed out into the trade. Sugar is an important factor in the prepartion of these articles for market.

Other industries might be mentioned, but enough has been said. It is only necessary to add in this connection that most of these industries which consume sugar largely are young; they are constantly growing and widening in their sphere. Taking into consideration the growth of these industries and the tendency of our people, as shown by the past, the demand for sugar in the future in this country is sure to be progressive and extensive.

Business men, farmers, and capitalists need not apprehend that our insular possessions will, under any conceivable condition of things, be

able to supply this country with an excessive amount of sugar. With our present demand and the growth of our consumption it will not be possible for our home producers and those of the islands to furnish all the sugar we shall need. It must be borne in mind that the available maximum production of these islands is practically known, as well as the limits which they can not exceed. For the remainder we will be compelled to buy sugars that come into our market from abroad.

The following statistics are compiled from an article in the Weekly Statistical Sugar Trade Journal, published by Willett & Gray. These statistics offer some very valuable information on the amount of sugar consumed in this country and the growth of consumption:

Tons[a] of sugar consumed in the United States in 1898, 1899, and 1900.

Classfication.	1898.	1899.	1900.
Net imports of foreign sugar	1,638,937	1,839,642	1,960,014
Domestic cane sugar	252,812	160,400	174,450
Domestic beet sugar	34,453	62,826	82,736
Maple sugar	5,000	5,000	5,000
Sugar made in United States from foreign molasses	1,700	5,200	7,647

[a] Tons of 2,240 pounds.

Consumption of sugar in the United States, 1881 to 1900.

Year.	Total amount of sugar consumed.	Increase (+) or decrease (−).[a]	Consumption per capita.
	Tons.[b]	*Per cent.*	*Pounds.*
1881	993,532	.....	.....
1882	1,061,220	+ 6.80	.....
1883	1,170,375	+10.30	.....
1884	1,252,366	+ 7.00	51.00
1885	1,254,116	+ 0.14	49.95
1886	1,355,809	+ 8.11	52.55
1887	1,392,909	+ 2.73	53.11
1888	1,457,264	+ 4.62	54.23
1889	1,439,701	− 1.21	52.64
1890	1,522,731	+ 5.80	54.56
1891	1,872,400	+22.96	67.46
1892	1,853,370	− 1.10	63.76
1893	1,905,862	+ 2.83	63.83
1894	2,012,714	+ 5.08	66.64
1895	1,949,744	− 3.27	64.23
1896	1,940,086	− 0.53	60.09
1897	2,070,978	+ 6.79	63.50
1898	2,002,902	− 3.29	60.30
1899	2,078,068	+ 3.75	61.00
1900	2,219,847	+ 6.82	66.60

[a] As compared with the previous year. [b] Tons of 2,240 pounds.

Forces which are Educating the People in Regard to the Beet-Sugar Industry.

In this report I have thought best to briefly review the various forces which are at work educating the people of all classes in America regarding the benefits, the methods, the art and science of the beet-sugar industry.

SYSTEMATIC PROPAGANDA.

In keeping with the public interest that has been aroused regarding this industry, are the systematic methods of propagating ideas touching the industry. Public meetings have been held in many localities during the past year. Meetings of this kind are attended by the business men and farmers of the respective localities. Speakers well qualified to present the various phases of the subject address these meetings. The methods of planting, cultivating, and harvesting sugar beets are discussed; also the conditions and requirements necessary to the establishment of a sugar factory, along with the cost of instituting the same.

The benefits of locating such an industry in that particular locality are outlined. This is the first step to arouse public sentiment. It is made pretty clear that the establishment of no other single industry could touch so intimately all phases of life as would that of the sugar industry. It is shown that it would give an impetus to several other industries, such as stock feeding and dairying. It is also shown that the production of sugar beets and the manufacture of the same into sugar involves an expenditure of a large amount of capital; that the demand for labor is greatly increased, so that no one desiring employment need go without it; that it increases the population of a district and stimulates business through all of its channels, and that a condition of prosperity prevails wherever this enterprise is instituted.

Other meetings follow, out of which crystallizes an effort to thoroughly and systematically test the conditions of the neighborhood for growing sugar beets. If results are sufficiently favorable, an effort is made to enlist the attention of capital to the extent of establishing a beet-sugar factory. These meetings give the press something tangible to present to the reading public, and before long farmers, business men, and capitalists are all more or less convinced of the mutual benefits that might be derived from building a sugar factory.

These meetings and the good work of the press usually result in the holding of a convention representing a large area or district. Experts and experienced beet-sugar advocates are called in, and the claims of this industry are presented in a methodical and systematic manner. Capital is usually represented. The final result is that a company is organized and the factory started. Future investigations simply become a matter of future experience in the practical operations of a concern.

FACTORIES AS EDUCATORS.

The education of the people on this subject has been aided by the building of sugar factories. A few years ago the existing factories were confined to a few localities. Persons desiring to gain practical information concerning the operation of a sugar factory or the raising of the beets therefor usually had to make long and expensive trips to

visit such factories. With the building of new factories the facilities for gaining such information have greatly improved.

The information gained by the farmer who is seeking light on the practical side of sugar-beet growing makes a much deeper impression on his mind when he is able to go into the beet fields near a factory, examine the soils, and talk to the farmers who produce the beets. Here he learns the soil and moisture requirements of beets; the methods of their cultivation; the average tonnage per acre and the market price; the cost of production and the profit or loss involved; the factory requirements regarding the beets; and many other important facts.

Capitalists and business men have the same open field for investigating their side of the proposition. Business men discover the benefits to all kinds of enterprises. In expending the money to build a factory large amounts of materials are used and labor is demanded. Most of the returns in money secured by the factory for sugar manufactured is spent in the locality or district for crude materials or some form of service. This is true with all of the receipts, in fact, except the profits of the concern, and these profits stay to enhance the values of the district if the concern is capitalized by actual residents. Capitalists, after a short investigation, are enabled to formulate correct ideas as to the cost of building a factory and the profits to be secured from its operation.

There can be no question as to the material value of this source of education. The owners of the earlier factories are to be commended for their liberality in devoting time and effort to the instruction of visiting committees who were seeking such information. I have never heard of a bona fide investigating committee of this kind to whom the factories did not give every opportunity to gather the desired facts.

The factories are not only interested in improving the conditions and facilities for making sugar, but they are also interested in bettering the methods of agriculture by which sugar beets are grown. Every well-regulated factory has what it terms an agriculturist. It is his business to supervise the growing of all the beets for the factory, and to secure the contracts from the farmers for the same. The factory must know that it is to have sufficient beets to carry it through the campaign and that these beets are of suitable quality. On this matter everything depends.

In the contracts with the farmers are the rules and regulations governing the treatment in growing the beets. The agriculturist makes a careful study of the best soils accessible to the factory and makes his contracts accordingly. He inspects and directs the growing of all the beets during the season, and issues notice to the farmers when to deliver their beets. The intimate relation which the factory sustains to the farmer, as a producer of its raw material, is one of the beneficial

things on the agricultural side of the question. The agriculturist is selected on account of his peculiar fitness and proficiency. He is a student of agriculture and an observer of its conditions. He is a great help to the agricultural community.

EXPERIENCE AS AN EDUCATOR.

In harmony with the confused state of the public mind in the beginning, is the lack of method and unorganized effort on the part of the management of new factories. In most instances the attempt has been made to organize a company, build a factory, and put it into operation within a year. There would be considerable hazard in this haste even if the projectors and everybody concerned, including the beet growers, had had experience and thoroughly understood their business. The bad effects of this hurry-up method become all the more apparent when it is understood that most of these companies are organized and the factories are built by men who know absolutely nothing about sugar making. They are located in farming districts where farmers know nothing about growing sugar beets except what they may have read or heard. They are absolutely without practical experience. And yet they are called upon to produce a crop of beets while the factory is building.

The difficulties in building a sugar factory are so many and call for such constant attention from those interested that they find their time thoroughly occupied. They have no time to give to the growing of the crop of sugar beets upon which everything depends for the success of the factory during the campaign. I have known those interested in building a factory to be so occupied with its construction that they were never able to get out and observe any of the fields of beets during the growing season. They did not know whether all the requirements had been complied with or whether none of them had. One of the managers said to me: "I have all I can do to build a factory; it is the farmers' business to grow the beets." There was no one delegated from this particular factory to make any observations of the crop or offer any help or instructions to the farmers. The results taught the managers of this factory, before they had finished the first campaign, that everything depended on keeping in close touch with the farmers. This was an extreme case, of course, but it must be apparent that, with the amount of work and worry required to build a factory in so short a space of time, very little time or interest can be devoted to the crop out of which the sugar must be made.

Factories usually have, and always should have, an agriculturist with a competent corps of assistants, through which the most necessary aid and instruction can be offered to the farmers constantly. As a rule these new factories start in depending largely on their skilled employees for information on all the lines from the time the seed is planted to

the time the sugar is placed on the market. This is necessarily the case. Men who have been interested in other lines of business have put their money into the concern. The farmers have been growing other crops whose culture is entirely unlike that of sugar beets. For a while the principal thing gained by those connected with such a factory as this is experience. This is one of the most necessary features in the development of the industry in this country. Unfortunately it is something that requires time, but as the work goes on each individual worker becomes more experienced; each learns to depend more on his own resources, and learns to shorten and lighten the labor which falls to him; he learns better methods, originates better processes, and becomes an artisan in so far as the scope of his talents and opportunities permits.

The man who has ventured his money in the enterprise, and who is the real power behind it, gradually gathers the information necessary to enable him to operate a sugar factory. He learns to examine and improve the machinery and the processes when it is necessary, and he learns when it is necessary; he becomes a student of the operation of the concern as a whole; he knows where to economize, and where to invest for the purpose of economy.

The farmer goes through the same course of practical education. Every year he is able to produce beets cheaper and better; he is enabled through experience to take advantage of all of the benefits incident to his participating in this industry; he will finally acquire the ability to produce the most beets and the best beets for the least money. His first experience is liable to be discouraging. His tonnage is low, the quality of his beets is poor; he discovers the causes, and aims at improvement in his next effort. He finally becomes master of the situation, finally discovers there is a vast difference between trying and knowing. He finds he has worked out his side of the task; he feels competent and confident; he knows that it is a profitable field crop. This difference between the results of an inexperienced farmer and a successful one through experience is the coefficient through which we determine the grand total of success by using as a factor the total number of farmers engaged.

At the Paris Exposition statistics were offered in the German department to show that Germany had been enabled to decrease her cost of production of sugar, during a certain definite time, 25 per cent.

In my last report I included the statistics of Germany for twenty-two years to show how she had gradually grown up in her tonnage per acre, in the sugar content and purity of the beet, and in the amount of sugar produced per acre. At the same time the cost of production had been gradually decreased. These are all important items redounding to the benefit of the farmer through experience.

When those in this country who are interested in this industry shall

have attained the proficiency which can come only through experience, then, and then only, will the industry be established under its best conditions. This must be borne in mind in making our estimate of the eventual cost of producing sugar here. When comparing our home industry with that of any other country, we must consider that there is a large amount of slack here that must be taken up. Another feature that we are entitled to consider is that the American, as a rule, has largely excelled artisans of other countries in his quicker and better methods, in his ability to cheapen processes and to make up to a large extent for the item of cheaper labor in other countries by his superior artisan ability. This has been demonstrated, and is being demonstrated every day in the manufacture of sugar. The tact, ingenuity, artisan ability, and hustling qualities of the American may be counted as an asset in favor of a better and cheaper production of sugar. These, along with the benefits to be acquired from experience, are features that are constant, and are bound to affect the future of sugar manufacturing in this country. Until such a time as we can thoroughly comprehend and calculate the effect of these factors we can not be able to give an accurate estimate of the cost of home production of sugar.

THE EDUCATION OF LABOR.

The question of high-priced labor, that must necessarily enter into all our estimates of cost of production, necessitates a constant vigilance in the point of quickening and cheapening the processes of manufacture. The very item which always appears to our disfavor in comparison with other countries offers the stimulus for closer investigation and for final favorable effect. Through experience we are educating our workmen, lessening the work, removing the obstacles, and meeting the problems which constantly occur. Each campaign brings forth better, easier, and cheaper methods. Each new campaign is entered upon with a new zeal for investigation and improvement.

It is interesting to note the limited amount of skilled labor with which new sugar factories begin their work. In the beginning considerable of this labor had to be brought over from Europe. There are certain places in a sugar factory that can only be filled by workmen skilled in a particular feature of the work.

When the fires are built and the machinery is started in motion, the education in sugar making of a large number of persons begins. This is the school out of which are to rise competent workmen who are to fill places of responsibility requiring previous training. Day after day the unskilled workmen follow through the details of their special work in sugar making, under the supervision of the skilled workmen in charge, until they finally become adepts. Each worker, from the one who shovels the beets into the irrigating channel for conveyance

to the factory to the one who watches the temperatures and consistency in the evaporators and boilers, daily becomes more expert in his particular part. He performs the operation with greater ease and greater success day by day. His education and his expertness are a part of the means of bettering and cheapening the factory operations. The company gradually increases the capacity of its factory, remodels its equipment, and cheapens the cost of production, until finally it reaches its maximum of efficiency in sugar production.

As the industry grows and other new factories are built, a demand is created for the services of the graduates from earlier factories. The new factory must secure a quota of men to fill positions of responsibility and requiring skill. This is the opportunity for the promotion of the workmen. Others are put into training for the places of those who go out. The drain is not permitted to impair the operations of the factory. Young men are carefully selected in the beginning and carefully trained. Under our system of popular education, the supply of raw material from which to select these workmen is peculiarly good as well as large.

In this country the young man is not bound by any decree of fate or custom to follow any particular occupation because his ancestors followed it. Here no one is required to inherit an occupation, but every one may select the occupation best suited to his inherited or acquired tastes and abilities. To this fact may be attributed much of the success attained by the American workmen. The factory owners are able to make their selections from young men who see in this industry a calling which meets their peculiar fitness, tastes, and ambition. They see in it an opportunity for promotion; they work in it inspired with the ambition of being future managers or superintendents. In this country such a thing is not only possible but quite probable. Our colleges of agricultural and mechanic arts are turning out a large supply of young men educated scientifically and practically. These institutions, with their thoroughly equipped laboratories, are furnishing abundant material for the needs of the beet-sugar factories.

American-Made Machinery and Implements.

Along with the progress that is being made in the manufacture of sugar from beets in America, and quite consistent with American character, is to be noticed the alertness of our machinery and implement men. From the beginning the manufacturers of factory machinery gave the beet-sugar factory careful study. A large percentage of the factories that have been built have been designed and the equipment has been planned by American architects and designers. A good percentage of the machinery in the factories is home manufactured. There is probably not a factory in this country that does not possess more or less of the American-made and American-designed machinery. Many of them are so equipped throughout.

Where most of the trouble has arisen on trial with new machinery the same has turned out to be foreign made; and it is a further very noticeable incident in this connection that where the machinery has been displaced in a sugar factory for the purpose of obtaining better results it has been largely at the expense of the foreign-made machinery by introducing something of the American pattern. Instances could be pointed out where factories were built no later than last year equipped with the latest foreign-made machinery, which was later torn out and replaced by American-made machinery at an expenditure reaching from $50,000 to $100,000.

We can confidently look to the future career of the American manufacturer for the new era in beet-sugar machinery. The same may be said in reference to agricultural implements for seeding, cultivating, and harvesting the beet crop. From the beginning the manufacturers of farming implements gave this subject careful attention and study. Experts were sent into the fields and implements were designed and put into use to meet the peculiar features of agriculture in the various sections. Results were carefully watched, implements were improved to meet obstacles encountered. The noticeable feature that appears in comparison with foreign-made machinery is that the American article is not nearly so cumbersome. It aims to accomplish the same results without so much laborious effort by man and horse. It is probable that the expense to the manufacturer of implements has been more than the profits he has derived. With true American enterprise he has anticipated the fact that this industry is to be established on a sure and extensive basis. His reward will come in the demand for this class of agricultural implements which is bound to come in the near future.

Constant progress has marked the history of this industry. In no other field of mechanics and agriculture have improvements been so pronounced. Its introduction into the United States is the beginning of a new era of discoveries and improvements. I will suggest some of the problems that are to be worked out in its inauguration here:

It is patent to everyone that the seeding and harvesting implements hitherto used have not been well adapted to saving time, labor, and expense in doing the work for which they were designed. For instance, 20 pounds of seed per acre are required in order to insure a crop. These seeds are sown continuously from one-half to an inch apart in a row. After the plants are up and when they possess three or four leaves most of them are cut out, leaving the remainder in bunches from 8 to 12 inches apart. If some successful plan could be arranged for planting them in bunches in the beginning it would do away with the labor of bunching and save at least two-thirds of the seed. This would save at least $1.65 per acre for seed alone, in addition to the cost of bunching, which would probably be much more.

Specially designed seeders have been offered to accomplish these results.

The implements for harvesting that have been in use hitherto simply loosen the beets, leaving the rest of the labor to be performed by hand. The beets must be topped by a laborer picking them up one at a time and giving a stroke of the knife to remove that part of the crown above the sun line along with the leaves. The beets are then usually thrown in piles and afterwards thrown into sacks, which are conveyed in wagons to the railroad car or factory.

Harvesting implements have been designed not only to loosen the beets, but to remove the tops, shake off the dirt, and to throw the beets into wagons as the machine proceeds. I am unable at this time to give a definite statement as to whether or not these machines are effective in doing the work properly and in lessening the cost of labor. Neither am I able to state at this time whether or not the planter described above is a success; but I believe that experience and trial will eventually lead to the saving of time and expense along the lines indicated.

Superintendents and managers of factories are giving special study to the details in the process of manufacturing sugar with a view to eliminating cumbersome methods and introducing effective ones. The operation of each piece of machinery is given attention, and new designs are introduced when it is thought the processes can be bettered. There is scarcely a manufacturing company that is not working out some peculiar feature of machinery or operation which has been suggested by experience. Some of these new features are made known; others are kept secret.

Bounties and Other Methods of Promoting the Industry.

Under this head attention is first called to the action of legislatures and courts in various States regarding State bounties. Promotion by bonuses and exemption from taxation by municipalities are then briefly discussed.

BOUNTY LEGISLATION.

Since my last report some of the State courts have taken definite action touching the bounty system. This is a method of encouragement devised for the purpose of stimulating the introduction of the sugar industry and attracting the attention of capitalists.

The States that have already paid bounties for the manufacture of sugar are New York, Michigan, and Minnesota.

The legislature of Illinois passed the bounty law offering 1 cent a pound on all high-grade refined sugar manufactured, on condition that the factories pay $5 per ton to the farmers for the beets. The governor vetoed the bill.

Some years ago Nebraska passed a bounty law devised to encourage

farmers and manufacturers; the following legislature refused to make the appropriation necessary to carry out the enactment, and the law was finally repealed.

In Minnesota the legislature passed the bounty law offering 1 cent per pound for all sugar manufactured in the State, and limited the expenditure in this direction to $40,000, distributing this amount pro rata among the factories earning the same. The bill was vetoed by the governor, but was passed over his veto and became a law of the State.

Other States in which factories are not yet established have bounty laws on their statute books. South Dakota, for instance, offers a bounty of 1 cent per pound. In Iowa the legislature passed an enactment remitting the taxes on all investments in sugar factories for a a period of ten years. In the State of Washington, where a factory is located at Spokane, 1 cent a pound is offered for all sugar manufactured. The total amount is limited to $50,000. The operation of the law is limited to a period of three years, and to factories which shall be completed prior to November 1, 1901.

Michigan has been the storm center of the objection to this bounty system. This probably grew out of the fact that nine factories were put in operation in Michigan in the short space of two years. The legitimate claims of these factories under the law seemed an enormous drain upon the State treasury. Under the terms of the law it was provided that factories were to receive 1 cent per pound for all sugar manufactured. The act appropriated $10,000 for the payment of the bounty and provided that any excess above that should be paid out of the general fund by warrants drawn against the same. The first factory built in the State was that of the Michigan Sugar Company, which drew the bounty for the first year, 1898, absorbing the $10,000, and then put in a claim for the balance from the general fund according to the law. Eight other factories were constructed and put into operation for the campaign of 1899. These nine factories produced 33,150,873 pounds of sugar, and under the terms of this law were entitled to $331,508.73.

The people of the State were confronted with an enormous drain upon their State treasury. These factories operating for the first year were late in beginning. They were in the experimental stage; they were working on the first crop of beets ever produced by Michigan farmers. Owing to all these causes it is probable that the factories did not produce sugar equal to half their capacity. Thus if no additional factories were built, the demands on the State treasury might reach something like $700,000. The following legislature undertook to amend the law by inserting one-half cent per pound instead of 1 cent, as under the old law; the governor had insisted in his message that there should be a clause limiting the maximum amount that could be paid to any one factory to $25,000. The legislature refused to take

this view of the case, and the governor vetoed the bill. This left the old law in force. The attorney-general rendered an opinion that warrants could not be drawn on the treasury for this purpose; that the object was not one for which a tax could properly be levied. The sugar factories insisted upon their right under the law. The matter was carried through the courts and finally it was decided by the Supreme Court that the law was unconstitutional and the attorney-general's opinion was sustained.

The States of New York and Minnesota are continuing to pay bounties and to encourage the industry in this way. It is usual for States offering bounties to require that factories pay an additional amount for beets, usually $1 a ton over and above the ordinary market price.

Is there any actual necessity for the offering of a bounty? There is sufficient profit in the investment, where right conditions prevail, without this additional encouragement. The offering of a bounty has more or less of a tendency to stimulate the location of a factory where the same might not have gone had everything depended upon the natural advantages. The future of this industry depends largely on the location of factories in places where they can be sustained upon the natural resources. If all the States keep their hands off in this matter, the first factories will go to places showing the best conditions for maintaining them. One failure will do more to discourage than many successes can do to encourage the industry. If any encouragement is to be offered, it should be done by the General Government, so that factories shall be left free to seek the places presenting the best facilities and natural inducements.

It certainly appears to be a hardship that a factory should be constructed in any particular State under the implied contract that said State will pay a bounty for a certain period, and then, when the factory shall have been built and the investor's money is tied up, the State should fail to keep its agreement. In the case of the State of Michigan much of the capital now invested in the sugar industry had been already organized and employed in other lines. The timber resources of the State were failing. In many large centers of the lumber industry the mills had closed for want of material to work upon; the fires were out and the capital was idle; the capitalists were looking around for something else to introduce in the place of their waning lumber industry. The State came forward and offered encouragement in the way of bounty on beet sugar. Factories were built immediately, expecting to participate in this State bounty. It was believed by investors that by the time this bounty expired by limitation the factories would be so thoroughly installed that they would be able to continue successfully without it. Under the court's decision they will of necessity have to succeed without it, if at all. This should have been the understanding in the start.

BONUSES AND EXEMPTIONS.

The promotion of this industry is attempted through a great many plans, ways, means, and, in some instances, "schemes." The method adopted by those imbued with public interest or local pride has already been presented. Most of those participating in public meetings and conventions, as well as those who write and lecture, are imbued with the idea that the industry would benefit the community as a whole. Such persons are working simply for the public weal.

There are persons of another class who help to stimulate local interest and organization because they would like to be connected in a practical way with the industry by investing capital and participating in the organization of the concern. Architects and designers of factory machinery also assist in the promotion and stimulation of local action and the investment of capital. The work of these classes usually promotes the industry in a legitimate way.

There is still another class of promoters whose operations are more confusing than beneficial. This is a class of men who assume to be experts on the subject of this industry, and usually claim to represent large amounts of capital, which is not apparent. They go into a community, agitate the question, hold public meetings, and arouse public sentiment, by giving the impression that they have unlimited capital behind them, and that they are on the eve of starting a sugar factory in the community. When public sentiment is aroused to a sufficient pitch, they make a proposition that if a certain bonus shall be paid by the community—usually so much land, and so much in money, running up into the thousands of dollars—they will secure the capital for starting a factory. Then, perhaps, the city authorities meet, remit the taxes, grant franchises, and guarantee privileges. The people organize, raise funds to buy the land, and to pay the extra in cash. Sometimes it is stipulated that the local community is to subscribe for a certain percentage of the stock. Sometimes it is required that the farmers shall subscribe for a considerable amount of stock and pay for the same in beets, so much each year. The local organization is required to secure contracts for so many thousand acres of beets for the factory. In many instances this is purely the work of bonus hunters with nothing back of them. They take the contracts from the farmers, the offer of a bonus in land and money, the franchises, privileges, the remission of taxes granted by the city, and start out to hunt up some capitalists who will take this job lot of public gratuities and give in return a good round sum, and possibly a position in the local organization.

It is not charged by the writer that all the promoters who travel around investigating conditions and interesting local communities are doing so without any definite means of accomplishing what they pretend. But it is asserted that this is true in many cases. In cases

where a community is once "taken in" thus, it is hard to arouse them again to the point of considering a really meritorious proposition where it is legitimate and bona fide.

When propositions are made by promoters, local communities, before they give up their time and energy and involve the public in consideration of the project, should first demand definite credentials. The promoter should show that he is able to carry out his side of the deal when the community shall have met the conditions proposed. The writer can not refrain, in this connection, from stating his belief that any considerable amount of bonus is entirely unnecessary. The offering of franchises and privileges and the remission of taxes do not seem to be objectionable, provided the community or municipality does not find it burdensome. The prospect of success in the proposed enterprise should be sufficient to induce the investment of capital without the additional encouragement of a bonus. It may be that concessions of a certain amount of land would not be burdensome, but the community should never be called upon to pay a large free cash subscription.

The question of local subscriptions for stock is another matter, simply a business proposition, provided such stock entitles its holders to participate in every way on an equality with all other share holders. This is a method of encouragement that may be recommended as wise and safe, provided conditions justify the belief that the sugar factory will be a paying enterprise.

If the entire amount of capital could be secured in the community, ideal conditions would prevail so far as capitalization is concerned. This would combine the entire influence of those interested in the success of the concern, and produce united energetic effort. This, however, is not possible in many instances, and a factory need not fail of building on that account.

Sugar-Beet Seed.

The growing of sugar-beet seed is an intricate process if the best results are to be obtained. No novice should engage in this enterprise. The sugar-producing quality of the beet has been built up through long years of careful study and work. It is the result of scientific breeding and selection. When the manufacture of sugar from the sugar beets began, they were considered of good quality if they possessed a sugar content of 6 to 8 per cent. At the present time the usual requirements for factory purposes is that sugar beets shall contain at least 12 per cent in sugar with a coefficient of purity of 80. All the localities now growing sugar beets for factory use in this country will show an average over these requirements. In some of the regions of California, notably the southern part, the averages are maintained as high as 16 per cent throughout the campaign. It quite often hap-

pens in cases of individual beets, especially where they are grown for experimental purposes, that they will run as high as 24 per cent sugar. This increase in the sugar content in the beet has come about in no haphazard way. It is purely the result of skillful effort and scientific direction.

Only those beets were selected as "mothers" for growing the seed which showed a high sugar content and coefficient of purity. The seeds grown from these beets were planted, and from the resulting crop beets were selected that showed the same high qualities, and seeds from these were planted for a third crop. This process was continued through a series of five years before the seed was considered fit to place on the market.

HOME PRODUCTION OF SEED.

It is gratifying to know that the industry of producing sugar-beet seed in this country is growing quite rapidly. It was early learned that the seed question was of considerable importance. When the industry started, and for some years thereafter, all the seed used was imported, mainly from Germany and France. Every year now adds largely to the home production of this commodity.

We have thirty-two factories in operation in this country, most of which are of large capacity; others are constantly building; we possess the largest factory in the world, and others that will compare favorably with the largest in Europe. It is entirely competent, in view of this fine start in the installing of this industry, that we should grow our own seed.

It is important, however, that those who undertake this task should be fully aware of the seriousness of the undertaking. The sugar beet of high sugar-producing quality was developed by exactly the same methods as the Jersey cow or the high-bred horse. It can be readily seen that a system like this requires careful attention, scientific knowledge, and expert direction. Not every seed grower could produce good sugar-beet seed, as is done in the case of other vegetables. He must first equip himself with the knowledge and with the facilities in the form of a laboratory and apparatus, which are necessary and expensive, in order to successfully carry on this enterprise. The beets must be kept up to the same high standard that has been maintained by the growers in Europe. When a farmer secures his seed from the producer in this country he must have the same assurance that they possess the quality. The value of his crop depends upon the sugar-producing qualities of the seed. The sugar manufacturer is also interested in the quality of the seed, because his success in making sugar from the beets depends to a large extent on the available sugar in the beet and the purity of the juice. These are qualities inherent in the seed. Breeding and selection must be strictly observed. The time

that has elapsed since sugar beets have been brought into requisition for producing sugar is relatively short compared with the time required to fix a habit or tendency in the nature of a plant.

The business of producing sugar-beet seed is the work of a specialist and not that of a common seed grower. If the methods here outlined are observed, the time is ripe and the opportunity is inviting for home production of seed. There will be a constant and a growing demand for this product. There is no reason why the home product should not be equal or even superior in quality to the foreign seed. It would certainly inure to the benefit of the beets if they could grow under the same conditions as affected the life and growth of their progenitors.

INSPECTION OF IMPORTED SEED.

So long as we are compelled to secure a considerable amount of our beet seed from Europe, some system ought to be devised for examining and testing the same. The Government has been giving careful attention to the importation of fruit trees, scions, etc., in order to keep out the infection of diseases and insects. It seems that some scheme should be devised for inspecting our importations of beet seed. While the consumer should be left free to import such varieties as he may deem advisable, yet those importations should pass through the hands of a competent inspector. This system would have a very salient effect on the quality of the seed brought into the country. The very fact that the seed has to pass through inspection would have a tendency to eliminate a large part of the poor seed from the original shipment.

The things most important to be secured by inspection would be (1) the quality of the seed for producing high-grade beets; (2) the vital or germinating power of the seed; (3) the cleanliness or freedom of the seed from obnoxious grass or weed seed.

The Molasses Problem.

Molasses is a by-product of the beet-sugar factory that has given the management considerable concern and a vast amount of study in the past. About all that can be said of it at the present time is that it can be classed largely as one of the wastes of the factory, and one of no inconsiderable moment. It contains the sugar which it has not been possible to separate from the other elements contained in the beet juice. Sugar beets often show as high as 16 per cent of sugar on the average; but it is not possible to secure more than 12 per cent in sugar. Indeed it is good work if a factory can secure 10 per cent of granulated marketable sugar. The balance of the sugar originally in the beet is to be found largely in the molasses.

The molasses also contains the salts and impurities originally in the beet. It is of a thick consistency, black, bitter, and very unpalatable. It is a matter of considerable importance to the factory, however, in

that it represents so much waste of time and product. Here is an inviting field for investigation and study for the man who desires to make himself famous as well as useful. How can this item of waste in the molasses be eliminated? How can the sugar be gotten out of it? By what process can this be done without the expense eating up the profits? If the sugar can not be gotten out, how can the molasses be made a valuable by-product? If it can not be made useful directly, how can it be made a raw material in the manufacture of some other useful commodity? In these questions is involved one of the leading problems of the sugar makers. The opportunity exists for materially cheapening the process of making sugar and increasing the output from a given amount of beets, provided this sugar can be secured. Considerable has been accomplished in this direction. It has been done largely through introducing more effective methods in securing the sugar from the beets. It has been done by taking the molasses after one process is completed and beginning on it with an entirely new process. Of these different processes we have the Steffin, the osmose, the crystallization-in-motion, and others. Nevertheless it remains a fact that, with any and all these methods, the factories have a large amount of molasses to dispose of in some manner.

It is quite common to hear that at some particular factory this problem is handled quite successfully. Such reports are heard only at a distance from the factory. This great saving vanishes as the factory and the facts are approached. This handling of molasses is the will-o'-the-wisp of the sugar business. It is the mirage that always disappears on investigation. No doubt most of the sugar has been extracted from the molasses at some of the factories, but it has been done at such an expense that it is probably not profitable.

The molasses has been turned to account in a great many ways. Methods have been devised for distilling alcohol, and this might succeed and be profitable were it not for the internal revenue which the distiller of alcohols and high wines must pay in this country. It has been used as a material for making shoe blacking, and other things. It has been mixed with the pulp in certain quantities for feeding to stock. In foreign countries it has been mixed with the pulp and dried, and this product has been shipped out as is oil cake in this country. Owing to its tendency to physic animals, it can constitute only a certain portion of the ration. Probably the best that can be said concerning the usefulness of molasses is that it can probably be used to a certain advantage in feeding it with pulp.

Conveyance of Juice in Pipes.

There is a limit to the distance at which it is profitable or desirable to deliver beets to the factories by means of wagons. This distance is governed by the kind of road over which these beets are to be con-

veyed. Provided the roads are such that two and a half to three tons may be delivered readily with a four-horse team, the distance is generally placed at 10 or 12 miles. Any beets produced beyond this limit should be taken to the railroad station and delivered to the factory in cars. The limit for profitable delivery of beets by means of railroads is generally placed at from 50 to 75 miles. This depends upon the freight rate charged by the road for this kind of freight. The factory management usually makes an endeavor to get the rate down as much as possible. It takes the matter up early with the road and uses the location of the factory on the particular road as a leverage for securing a contract with the road governing the cost of freight.

Even the facilities of railroads for furnishing beets from the surrounding territory are limited. Outside of the wagon limits, and the strips of land bordering the railroad each way for 50 to 75 miles, the farming lands are unavailable. Even were it possible to raise sufficient beets in the territory indicated, difficulties often arise, crippling the work of the factory. Washouts often occur, delaying the beets; the beet crop matures and is ready for delivery at a time when much other farm produce is also calling for transportation; cars become scarce, and the factory becomes hampered in its supply of beets; sometimes it is compelled to shut down until the sheds are filled. All this is unfortunate and expensive to the factory.

A system has been devised for delivering the juice instead of the beets. This is accomplished by means of a pipe line laid in the ground at a sufficient depth. This pipe line is of steel capable of standing high pressure. In different directions from the factory, slicing stations or plants are established. These plants are auxiliaries to the main factory; they are equipped with sheds and all the outer equipment for a factory in addition to the beet slicers and the diffusion cells for extracting the juice. They also have heating facilities and limers for the purpose of preparing the juice for transportation. The juice is forced through the pipe line by means of pumps (possibly by gravity) to the main factory. Here the juice is treated exactly the same as that extracted from the beet in the main factory itself. This method has been tried in Europe, and there is more or less conflict of opinion as to the results. It is being extensively and successfully tried by the Utah Sugar Company, located at Lehi, Utah. This factory is under the management of Thomas R. Cutler. It was through his investigations of this method in Europe and his representations to the management that this system was introduced. We quote some of the things he has to say on that subject:

Last year we enlarged the central factory at Lehi and put in an auxiliary plant at Springville, 22 miles south of Lehi, and another one at Bingham Junction, 19 miles north of Lehi, giving us a double pipe line of 41 miles. We understand that we have the longest pipe line for beet juice in the world, 22 miles in length from Spring-

ville. We also trebled the capacity at Lehi so that we could work at the central plant the juice from 1,200 tons of beets per day, and we have run that many beets through several days this last season.

I am not able at this date to summarize the working expenses of our auxiliary plants, or to say whether they are conducive to economical working under general conditions, but the conditions in the interior the last two years in regard to facilities for the carrying of our beets have been excruciating, and we were compelled to take some steps so that our farmers could get their beets to the central factory. No other way offered itself that seemed to meet the emergency except that of building auxiliary plants. We pay the same price per ton as when delivered at the central factory. Our prices for 1900 were $4.50 per ton for beets containing not less than 14 per cent sugar with a purity of 80, $4.25 for beets containing 13 per cent sugar with a like purity, and $4 per ton for beets containing 12 per cent sugar with the same purity. The average quality of the beets was 14.1 per cent, with a coefficient of purity of 82. Our entire loss was only 2.8 per cent. We used the osmose process on our low-product molasses.

There is a strong probability of our putting in another auxiliary plant or cutting station at a point on our pipe line south about 14 miles from here this spring, so as to have it ready in time for this season's work, and this will be done for the same reason that we built the others, viz: On account of the extreme scarcity of cars at our disposal during the months of September, October, and November.

It can be readily seen that if this system shall prove a success, it will change materially the status of the industry. Some of the objections offered are that the quality of the juice will deteriorate in reversions; that the liming of the juice will interfere with its conveyance, but Mr. Cutler, quoted above, says: "We feel that we can say, however, that with us they (pipe lines) are a perfect success."

This plan makes it possible to establish a large factory (as in the case of the Utah factory) at some central point. And then at distances convenient for the purpose, slicing stations can be installed. The people living in the vicinity of these stations have most of the benefits enjoyed by those near a regularly equipped factory. The farmers have the convenience of delivering their beets in wagons and returning home with loads of pulp for feeding their stock. A farming community that has not the capital to build a factory or the opportunities to secure outside capital may instead secure one of these slicing stations.

This plan will have a great tendency to increase the capacity of the main factory. Almost any company will be in a position to inaugurate this auxiliary system by increasing its capacity for working the juice. The system seems inviting, providing it is practical to convey juice in this way. It would certainly be cheaper to force the juice the same distance than to haul the beets by any method of conveyance.

It is a system that augurs much under our peculiar conditions if it shall prove a success, which seems probable. At least it is one of the industrial problems to be worked out in this country. It may have much to do with the future of the industry. It is one worthy of careful consideration.

Irrigation.

We have vast areas of land in this country that is peculiarly susceptible to reclamation through irrigation. Most of this land proves itself to be good soil for the production of sugar beets, provided moisture is secured. We began the business of growing sugar beets with very little information as to the effect of irrigation. We have worked out the main facts ourselves.

Utah has offered a large fund of information on this subject. The original settlers of Utah began by raising products under almost desert conditions. They devised and put into operation a system of irrigating ditches that is a model. Under their system small farms are the rule, and the resources are carefully husbanded. The sugar factory was installed in a section having small, carefully tilled, irrigated farms. Previous experiments had shown that it was possible to grow sugar beets by irrigation. This question was put to a practical test. There is sufficient rainfall to sprout the plants and start them on their growth. In order to complete the crop it is necessary to resort to irrigation. The amount of irrigation depends upon the amount of rainfall, and it is only resorted to when necessary. The experience of eleven years has shown that sugar beets can be successfully produced by irrigation, but there are many things in irrigation that must be studied and applied with reference to this particular crop.

New Mexico followed Utah's example. Sugar beets have been grown in the Pecos Valley, where the necessity for the application of moisture through irrigation is greater than in Utah. The results of this test also show that the crop can be produced in this way.

Next came Colorado, with the establishment of a factory at Grand Junction, where a large part of the moisture was applied through irrigation. Factories were also started in the Arkansas Valley, Colorado, at Rocky Ford and Sugar City, where irrigation will again be put more or less to the test. The lack of sufficient rainfall in California has opened up this question there. Every year adds more to the amount of territory where sugar beets can be grown through irrigation, if necessary, and where they are actually grown in this way.

The resources for establishing artesian wells are being investigated, with a view to securing an available supply of moisture for growing sugar beets. Problems of storing water in the mountains, to be used in the irrigation of crops in the valleys, are becoming matters of interest to the National Government. Special features of applying irrigation to sugar-beet crops are questions for careful study throughout these arid sections.

The really hopeful feature of the present tendency in factory building is the future which opens through this industry to the arid parts of our country. As experience with irrigation has accumulated definite knowledge of results in growing sugar beets, it has been found that

their production appeals more for its introduction than does any other product. Beet culture presents a twofold claim on this region: (1) It has been shown that with sufficient moisture a greater success can be made with this crop than with any other; (2) at the same time it has been shown that the sugar beets grown in these arid regions during the past year (1900) have maintained a higher average sugar content and purity than those grown any place else. This gives the farmers of these sections a new crop resource which seems fitted in every way to reach its best results under their peculiar conditions. It adds to their rotation and will affect very materially the resourcefulness of the arid section.

The history of agriculture and mining in these Mountain States presents a very close analogy. The first mining of the country was confined to the rich outcroppings, only the rich ores being worked. In this way the whole mining region was skimmed. Later new processes were discovered for working lower-grade ore, and the old dumps and abandoned claims became even more valuable than the pioneer rich mines. Original agriculture in these States followed the streams and selected spots where moisture would prevail. The large fertile valleys, more arid, were avoided. The science of irrigation has progressed. Flowing streams have been tapped and the water turned onto these arid plains, showing results far more important than those from the lands originally cultivated. These results rival the best in the Mississippi Valley. In fostering the agricultural industries and seeking for crops that are suitable for the arid region, the Government has builded better than it knew. In attempting to better the condition of its citizens, putting them in position for establishing lucrative farms and prosperous farming districts, it has greatly enhanced the value of its own possessions.

In the settlement of the country these arid lands have been avoided on account of their lack of moisture. A large portion of this land still belongs to the Government, and has hitherto served no purpose except that of grazing. Several acres of land are required for grazing one animal. These lands can be made and should be made more productive. Throughout the length and breadth of these arid regions vast quantities of water are running away to the sea. The plans devised at present for irrigating take their water from running streams. This would utilize during a part of the year—the growing season—some of this water. During the other part of the year and at the time of the heavy rains and movement of the snows by melting, the water escapes through its various channels into the sea. These waters should be stored and let down into the valley gradually, thus multiplying their utility many times and multiplying as many times more the amount of land that can be brought into usefulness. Wherever land is recovered in this way and given a permanent, sufficient, available supply of water for producing crops, its value is enormously increased.

The Feeding of Pulp and of Beets.

Here is another great opportunity for utilizing the benefits of the sugar industry. Sugar beets are a valuable crop to grow on a farm for their feeding value alone. After the sugar contained by the beet is extracted, they are almost as valuable for feeding purposes as they were before. The idea naturally presents itself that the farmer would find it especially profitable to grow the beets and sell the sugar they contain to the factory and have the pulp for feeding. In previous reports I have had considerable to say on this subject. I have offered the evidence of the most extensive and successful stock feeders in this country, have given the results of exhaustive experiments which they have made, and have shown that pulp is the very best food in the ration of the dairy cow. After stock has been trained to eat it, there is nothing that gives as good results in all kinds of general feeding as a certain amount of this sugar-beet pulp.

PULP FEEDING.

In my report for 1899, attention was called to the results of large feeders at Grand Island, Nebr.; also to those obtained by the Standard Cattle Company at Ames, Nebr., probably the largest feeding enterprise in this country. It was shown that after experimenting with pulp in feeding sheep and cattle, this concern through its stockholders stimulated the organization and building of a sugar factory in that vicinity. The prime object to be attained was the securing of the pulp for feeding which this factory would turn out. After sugar beets have been through the factory there remains in this by-product about 45 per cent of their original weight. This factory at Ames is one of 500 tons daily capacity. It, therefore, turns out in its daily run over 225 tons of pulp. This pulp is easily stored and preserved. In this particular case, it was usually hauled out into the feed lots like other coarse feed and consumed daily. If necessary it will keep for two or three years and still be valuable for stock feed. The action of this company is a strong argument in favor of the desirability of pulp for stock-feeding purposes. Its utility must have appeared great to cause a concern of this kind to invest capital to the extent of $600,000 or $700,000 simply to get this product. Strongly as it appeals to those posted on the subject, it has been a strange fact that the farmers at large have been so slow to recognize its value. It has been mostly the large feeders or companies organized for feeding purposes who have taken advantage of this source of securing desirable and cheap feed.

Many of the factories have had in the start to offer their pulp at 10 to 35 cents a ton, and in some cases they have given it away in order

to get it out of the way. In isolated cases farmers took up with the proposition readily, but it seems it has taken a great deal more time than should have been required to convince the ordinary farmer.

The American Beet Sugar Company, of Oxnard, Cal., has itself taken hold of this question, built large stock yards and is feeding a large number of cattle from its factory.

When we compare the action of the Oxnard factory with that of the Standard Cattle Company at Ames, Nebr., we can comprehend the strong mutual relation that exists between the sugar manufactory and the feeding industry. One, a feeding concern, builds the factory to get the pulp for its cattle and sheep. The other, a factory concern, establishes immense stock yards and buys up a large herd of stock in order to dispose of the pulp. It only shows that information is the thing required.

In New York almost every farmer is engaged more or less in dairying. He lives in proximity to some large trade center. The people of this center must be supplied with milk, butter, and cheese. At these centers are located factories working on cereal products. They are manufacturing starch, beer, and other products. They have a large output of by-products which is returned to the farms for feeding purposes. This refuse has shown itself through years of experience to be especially valuable as food for the dairy cow. The farmer is educated as to its utility. In order to produce his milk cheaply and successfully he must resort to this kind of feed, as does every other farmer.

The farmers of New York were especially inclined from their past experience to accept the proposition that sugar-beet pulp was a good feed. When the factories started in New York it was with the advantage of being able to readily dispose of their pulp. In the beginning the factory at Binghamton was able to turn off its pulp at from 50 cents to $1 per ton. It will be able to get more per ton as the demand grows stronger. All the factories that have been established in other States will finally be able to sell their pulp. The demand will grow and the price will increase. They will have to educate the farmers in their vicinity to the point where the New York farmer began.

Mr. Robert Oxnard, at a banquet recently given at Rocky Ford, said, among other things, in speaking of the benefits which would accrue from the establishment of a sugar factory:

> It means that the cattle feeder and the sheep feeder are given at a nominal price one of the best fattening and dairy foods known. After the sugar is extracted the pulp is almost as good as the beet itself for cattle feed, and no farmer is doing justice to himself who does not take his proportion of pulp and, after turning off a few fat steers or sheep at a good profit, return to the land in the shape of manure that which he took from it.

The reporter for the Beet Sugar Gazette, Chicago, Ill., has the following to say of pulp feeding at Los Alamitos, Cal.:

> Live stock is in excellent condition, especially that which has been fed upon pulp. The best effect of this food was shown in the great improvement made in the Los Cerritos Company's herd of 150 cows, which increased in weight of milk 160 per cent, with an increase of 0.6 per cent in the content of butter fat. The pulp is fed to the cows in troughs, where they are allowed to lick it up at will, allowing about 80 pounds per head; for roughness they are fed alfalfa hay. These two foods alone constitute their ration, upon which the cows not only improve in product, but keep in better health, and some of them even lay on flesh. The pulp is relished equally as much by hogs, a large number of which are kept in connection with the dairy.

It is unnecessary to add testimony in support of the proposition that sugar-beet pulp is valuable for feeding purposes. This is generally accepted now by those best posted in agricultural subjects. Wherever a sugar factory has been established, enough of this by-product is fed to thoroughly demonstrate its utility as food. The agricultural press, the general newspapers, and the leaders of agricultural thought will keep this matter before the public until it will be thoroughly advised thereon. These factories will all eventually dispose of their pulp at a remunerative figure, or else it will be returned to the farmer under some such arrangement as is now adopted by the creameries with skimmed milk.

In any case the farmer and the manufacturer are bound to be mutually benefited. Pulp feeding is one of the strong salient points in favor of the beet-sugar industry as against the encroachment of cheaper sugars produced in the Tropics. The stimulus it gives to the stock and dairy industries must be counted in favor of the general resources of the beet-sugar industry.

This problem will have been fully worked out when the value of this by-product is as thoroughly appreciated as it is in the sugar-producing countries of Europe. This will be when every consumer of feeding commodities appreciates the value of pulp for food and is making a demand therefor. In those countries, stock is not only fed pulp in the manner described above, but machinery is installed in the factory for preparing it and sending it out in convenient form. The pulp is dried and pressed and sent out as is the oil cake of the flaxseed-oil factories in this country. It is very much reduced in bulk and weight, and its feeding value is increased. It can be readily sent to the retail feed stores and doled out in parcels, as is now done with bran, oil cake, etc. This dried, specially-prepared pulp sells on the market for $1 per hundredweight. This brings the citizens of cities, towns, and villages in as customers for this by-product of the sugar factory.

The writer is unable to state whether or not the dried product is more available, palatable, or desirable than the fresh pulp. It is a fact, however, that the demand is very strong for it in Europe and it holds a very high place on the list of feeding products on those

markets. If the same shall be the case in this country, this general demand will very much increase the usefulness of pulp, and make it still more a factor in the question of sugar producing. We are not long to be left in the dark. Several of the companies are now installing departments and apparatus in their factories for drying this pulp. Some of them are accepting the machinery with the proviso that it shall be retained as a feature provided it is successful in turning out a product that is desirable and useful. Among the factories at which this matter is being tested are the ones at Binghamton, N. Y., and Holland and Bay City, Mich.

USE OF BEETS IN FINISHING CATTLE.

Prof. C. F. Curtis, of the Iowa Experiment Station, says in the Beet Sugar Gazette:

From our experience here in the use of beets in finishing cattle of high quality for the block, I have no hesitancy in saying that the introduction of roots and the beet product into our fattening rations will result in a higher and more desirable finish, and a vastly better product. All of the cattle that have been marketed by the Iowa station and killed with such good results have been finished on a ration consisting in part of roots. Some of these cattle were on feed a year, and carried to an unusual degree of ripeness, and yet not one of them was what might be termed overdone. When one of our best carload lots was hanging in Swift & Co.'s cooling rooms the head cutter and manager remarked: "Look at them. Did you ever see as highly finished a bunch of steers without a patch on the carcasses anywhere?" The use of root crops enables the feeder to make a better and more desirable carcass of beef than can be made on dry feed alone. The animals fed roots are mellower to the touch, evener in their flesh, and in better bloom than it is possible to obtain on dry feed, and the gains are larger and more economically produced. The same advantages apply even in greater degree to the use of roots in the ration for breeding stock. It will pay to establish root culture on the stock farm, whether we make our own sugar or not. I spent a day on the farm of the Standard Cattle Company at Ames, Nebr., where 3,000 cattle were on grain. Mr. Allen, the manager, was then feeding beets quite extensively. These were purchased from neighboring farmers at $1.50 per ton, and considered profitable feed at this price when corn could be obtained at from 18 to 20 cents per bushel. I never saw cattle appear to be doing better or in a more thrifty condition. Mr. Allen also states that until they began feeding roots they were troubled with hog cholera, but since then they have not had it.

FERTILIZING AND CULTIVATING THE SOIL.

One of the strong points in favor of beet-sugar production is that a large area of our country is capable of producing the crop without the aid of anything but the ordinary barnyard manure. In Germany and France it costs $20 to fertilize an acre of ground by the use of commercial fertilizers. In the Hawaiian Islands it costs $22.50 per acre for fertilizer in order to produce a crop of sugar cane.

We have considerable scope of country devoted to the raising of sugar beets upon which nothing can be successfully grown without the application of more or less commercial fertilizers. It may be demon-

strated that all the soil devoted to this use could be made more responsive by the use of some of these commercial fertilizers. As a general proposition, it can be stated that our soils are considerably less expensive in the demand for fertilizers than are those upon which the sugar beets of Europe are grown. However, it is more or less an open question how much and what kind of fertilizers should be used here. This is a subject which is constantly under investigation. The solution of the problem will affect more or less the quantity and quality of our future beet crops.

There is another item that will have a strong bearing on the future production of this crop, and that is the kinds and methods of cultivation. It is being pretty thoroughly demonstrated that the method of cultivation adapted to one section will not answer the purpose in another. It is a matter of experiment to know just what kind of cultivation should prevail in any particular section. In some places deep plowing seems absolutely necessary; in others this is not a real requirement.

There are some who insist that sugar-beet land should be selected from the stubbles and meadows; that it should be plowed the year before, and replowed and harrowed just before planting. It is claimed by them that the fallowing of the land for a certain time, followed with freezing, puts the soil in the best condition for planting sugar beets. Others claim that the very best land that can be selected is that which has been in corn the year previous. They say that, while it takes a little more trouble to remove the stubs, yet the cultivation the soil received the year before is necessary to give the best results with a sugar-beet crop. Of course this argument would apply to most of the other cultivated crops. The writer's observation leads him to believe that both these classes are right. They are both giving expression to their actual experiences. The variance in methods arises from the different requirements of the different sections. For instance, large areas of sugar beets are grown in this country where freezing does not obtain at all. And in other sections of the country, especially in the Mississippi Valley, results are obtained by rotation that farmers in another section would have to obtain by fallowing and plowing. The kind of cultivation needed must be settled for each district according to its own peculiar requirements. This problem is now under investigation, and eventually each farming district will have its own "right way." The solution is being worked out on the farms. Finally, we shall have standards governing the kind and method of cultivation, and the sugar industry will be greatly benefited by the information obtained.

In discussing the future of the sugar industry from the agricultural side, and giving the list of benefits that must result from experience and practice, we must not overlook the lasting benefits to be derived by the soil itself from intensive cultivation. Whatever be the method

of cultivation prevailing, there are a few points that must always be observed in the cultivation of sugar beets. The ground must be kept clean and free from weeds; it must be thoroughly plowed and cultivated; it must be kept in a high state of fertility through the application of barnyard manure or commercial fertilizers.

In the harvesting of the crop the ground is again stirred. The refuse of the crop, if it is not fed, such as the tops and crowns, containing valuable fertilizing elements, are left on the field. This is usually the case. These readily decay and enter again into the fertility of the soil. The ground, through its numerous cultivations and stirrings, is rendered very soft and pliable. Being free from weeds and grasses it is in a fine condition for producing crops. By a proper system of crop rotation the farmer is constantly bringing other parts of his land under this high state of cultivation. Every succeeding crop teaches the benefits to the farmer to be derived from intense cultivation; finally it becomes the rule of his system. Of the benefits which come from installing the beet-sugar industry, we must count soil improvement by high cultivation an important item. It is an item that will in the future inure to the general benefit of agriculture throughout the country.

The following are the deductions of the Michigan State Experiment Station from the experiments with sugar beets in 1899:

Subsoil plowing practiced immediately before sowing the beets, owing perhaps to the severe drouth which followed, resulted in the complete loss of the crop.

Coarse manure applied some two months before sowing the beets resulted in increased yield and beets of a normal percentage of sugar.

Carefully prepared home-mixed fertilizer gave higher yields and better beets than stable manure.

Nitrate of soda alone gave no marked increase in yield, but in combination with other elements generally increased the yield with a normal percentage of sugar.

In every case nitrate of soda gave higher yields than sulphate of ammonia.

Wood ashes and salt increased the yield of beets slightly.

One ton of air-slaked lime per acre increased slightly the yield of beets on the uplands without affecting the percentage of sugar.

On muck land, one ton of air-slaked lime per acre in combination with other fertilizers decreased the tonnage 11 per cent and reduced the sugar content from 9.64 to 7.68 per cent. When lime was applied alone on muck land, increased applications increased the tonnage of beets but decreased the percentage of sugar.

Early planting gave larger yields and slightly higher percentage of sugar.

Clay loam soil produced the largest tonnage and the highest percentage of sugar; followed by other soils in the order below, except that the tonnage on muck is next to clay loam: Sandy loam, sand, clay, muck.

During the past season there was a slight falling off in sugar content of growing beets from October 19 to November 23.

Conservation of Factory Utility.

The time for an active campaign in the manufacture of sugar from beets is usually placed at from three to four months. The fact that the factory is idle the rest of the year with its large equipment of

machinery and its large investment of capital seems an expensive feature of the business. This question is pertinent: "Why can not these factories employ their time during the rest of the year in some other line incidental to the manufacture of sugar?" This question is constantly occurring and recurring to those who investigate the subject. This question has been the subject of careful consideration by some of the manufacturers. At the present time we have organizations that are projecting plans for the establishment of beet-sugar factories so arranged that the factory can be made useful most if not all the year. Owners of some factories already built are studying these propositions.

The Hawaiian sugars must be refined in this country. All our importations are in the raw form. The question has arisen: "Why not, in the original plan of the coast factories, include facilities for refining on a large scale, so that the furnaces, engines, and many other parts of the factory, as well as the labor, might be employed continuously in refining sugar when not manufacturing it?" At Omaha, Nebr., an organization has been considering the feasibility of erecting a factory that will manufacture sugar from beets during a regular campaign, and then utilize its resources during the rest of the year in the manufacture of starch. In Illinois, the building of a sugar factory that can manufacture glucose during this idle period has been seriously contemplated. If factories can be utilized in such ways throughout the year, it will cheapen to a considerable extent the production of sugar.

Crop Conditions and Factory Operations during 1900, by States.

The results of agricultural operations should always be viewed in the light of the conditions under which they have been achieved. This is especially true of sugar-beet culture. It is therefore necessary, in order to estimate the degree of success achieved in the beet-sugar industry during 1900, to review the climatic and other conditions under which the crop of sugar beets was produced. This will now be done, taking up the States in alphabetical order.

IN CALIFORNIA.

In growing sugar beets, California has climatic conditions peculiarly her own. The cropping of sugar beets in this State began on what is known as the damp lands. These have natural subirrigation, or underseepage, from which the beet crop draws a supply of moisture during its growth. The first prerequisite is that there shall be a large rainfall in the winter to thoroughly saturate the soil, not only that upon which the beets are planted, but that of the uplands and mountains. This winter saturation serves two purposes: (1) It supplies sufficient moisture for sprouting the beet seed, as they are planted in late winter

or early spring: (2) it causes the subirrigation of the beet fields during the growing season.

If the beets receive a good rain or two after they have fairly started, the crop is assured in these sections. There is no question about the resources of the soil. The results of many years have shown that these soils will produce an abundant crop of high-grade beets whenever the moisture is secured.

The one source of encouragement that remains to the residents of southern California is the fact that the record of a long series of years indicates that the rainfall in the last three years has been abnormally low. The farmers confidently look for a return of conditions more in keeping with the history of the State. So far as the sugar-beet crop is concerned, it is not especially desirable that the average rainfall per annum shall be large; it can get along with much less rainfall, provided the same comes at the proper times to supply the needs of the crop.

The winter saturation for this purpose in 1900 was not at all satisfactory in California. As a result, not nearly so large an area was planted with sugar beets as might have been under more favorable circumstances, and the earlier beets planted did not make a favorable start. In the latter part of April and the early part of May the precipitation of moisture was about 3 inches in southern California. This was followed by a good rain about the 1st of June. The results of these rains were that, where a good stand had been secured on first planting, an excellent crop of beets was assured. It also offered an excellent opportunity for late plantings in soils well saturated with moisture, which afforded better returns than was formerly thought possible. The conditions were especially adverse in the districts of Chino, Los Alamitos, Oxnard, etc. By the late rains, however, prospects were very much improved.

During the last few years, the northern part of the State, while not affected so much, was cut short of a normal crop, varying from a half up according to the location. This protracted drought has resulted in some permanent good. It has stimulated the employment of irrigating ditches in growing sugar beets.

At Chino over 1,000 acres of beets were grown this year by irrigation, and in some of the districts where sugar beets are grown for the Los Alamitos factory artesian wells were sunk, having a good flow, bringing lands into use that will have a permanent supply of water and making them more reliable resources to the factory.

At Oxnard and Salinas irrigation is becoming a feature of sugar-beet growing. Throughout all the valleys where this crop is grown, irrigation is being more or less resorted to. The limit of assured yearly production in southern California will be very much enhanced by the amount of available lands subject to irrigation.

Fogs, which furnish more or less moisture to the soil, have much to do with the success of a beet crop. Their presence indicates the absence of wind, and prevents heavy evaporation of the stores of moisture in the earth. Sugar beets get along with considerably less moisture, either by rainfall or irrigation, according as these fogs are absent or present. They have been more abundant and have stayed longer than in the past few years.

There has been considerable agitation of the labor question in California during the past year. Negotiations were entered into with a colony of Russians who had settled in Canada. An effort was made to get about 20,000 of these to settle in California and engage in sugar-beet growing. Some of them came. Many of the settlers in these valleys objected to this importation of foreign labor as tending to lower wages. It was contended on the other hand that these settlers are experienced in growing sugar beets. It was claimed that experience had shown that the average American farmer is not prone to enter into the drudgery incident to the production of this crop. This kind of labor in California was formerly the specialty of the Chinaman. He is to-day the market gardener and the farm or ranch laborer whenever his services can be secured. By many he is regarded as the most satisfactory laborer from an agricultural standpoint tried in California. The Chinese are becoming scarce; the operations of the Chinese exclusion law has set a limit. The Chinese labor has been estopped from coming into this country, thus effectually shutting off the supply. The laborers who are here eventually return to their own country, which, along with the natural mortality list, is gradually reducing their number. An attempt has been made to fill the place of the Chinaman by bringing in Japanese. It will take time to determine whether he will be willing and able to do so. Thus California is in a sort of transitional stage so far as labor is concerned.

Hawaii, hitherto more familiar with Japanese labor, is also agitating this problem. Several carloads of the southern negro laborers have recently been taken to Hawaii to work on sugar plantations in order to test their efficiency.

An equilibrium of wage conditions between the Pacific coast and the Hawaiian Islands must eventually be reached. There is a sort of mutual relation existing between these islands and California. The similarity of their conditions and productions seems to demand a close relation of interests. Hawaii is following closely in the footsteps of California in the manner of developing her industrial features. California has to pay about $30 per month for efficient labor in the beet fields. Formerly the wages paid were similar to those which obtained in Hawaii a year or two ago—namely, $12 to $15 per month. Everything is tending in Hawaii to increase the wages, and I believe the time is not far distant when California and Hawaii will both be paying their laborers substantially the same daily or monthly hire.

Los Alamitos.—The Los Alamitos Sugar Company is operating a factory here of 700 tons daily capacity. Owing to the winter drought, which was protracted into the spring, the company and farmers almost despaired of being able to produce a crop of beets. Spring rains very much improved the situation, and the district started in to produce a crop, with a fairly encouraging prospect. About 2,700 acres were planted in beets. The discovery of artesian waters available for use in irrigation was the feature of the year's developments. Several were sunk, and indications point to more in the future. To the extent of the ability to apply irrigation in this way will the factory be benefited and assured of its future crop.

The present winter (1900–1901) conditions have been very favorable for the success of the beets to be raised the coming season. A large rainfall occurred the latter part of November, which was followed with copious rains in December and January. These latter rains came down gradually, covering a period of two or three days each time and recording from 2½ to 3 inches. This starts the crops off with every assurance of success. The land is in fine condition for plowing and seeding, and, with a few showers during the growing season, the farmers of Los Alamitos should be able to realize a splendid crop.

Results at Los Alamitos during the year 1900.

Date of starting the factory	21st of August
Date of closing the same	20th of September
Number of days factory was in operation	31
Number of acres planted to beets	1,500
Number of acres of beets harvested	1,070
Quantity of beets worked, tons	7,500
Average cost of beets per ton	$4.80
Average yield of beets per acre harvested, tons	7
Average sugar content of beets worked, per cent	17.32
Average coefficient of purity	82.5
Amount of sugar produced, tons	750
Sugar in process, do	60
Total number of employees for the campaign	145

Chino.—The American Beet Sugar Company is operating a factory here of 1,000 tons daily capacity. Crop conditions at Chino during the past year were quite similar to those described for Los Alamitos. The new feature of the district was the amount of beets grown by irrigation. The American Beet Sugar Company concluded not to operate the factory, but to ship the beets grown here to Oxnard, to be worked up along with beets grown for the Oxnard factory. This company seems to be making every effort to stimulate the farmers in the production of beets. The following item from the Beet Sugar Gazette shows the prices to be paid in the future for beets:

The American Beet Sugar Company of Chino has made a substantial increase in the price of beets for the next campaign. The factory will pay $4.25 per ton for all

beets weighing not to exceed 5 pounds to be raised during the 1901 campaign, regardless of sugar content or purity, and an additional 25 cents per ton will be paid for each per cent above 15. The price prevailing during the season now closing, as in other recent years, was $3.50 per ton for all beets containing 12 per cent sugar, with an additional 25 cents per ton for each per cent above 12. Beets falling below that standard were subject to a discount of 75 cents for each per cent under 12. Thus a beet of 11 per cent sugar brought $2.75, and one of 10 only $2.

Results at Chino during the year 1900.

Number of acres planted to beets		2,299
Number of acres of beets harvested		1,230
Quantity of beets shipped to Oxnard factory	tons	4,145
Average cost of beets per ton		$4.15
Average yield of beets per acre	tons	3.29
Average sugar content of beets worked	per cent	14.5
Average coefficient of purity		78.6
Number of employees kept the year round		15

Oxnard.—The American Beet Sugar Company is operating a factory here of 2,000 tons daily capacity. The same winter drought described for Los Alamitos and Chino prevailed here, but the later spring rains did much to recoup the district. The record of the year was not a very high tonnage per acre, but the percentage of sugar in the beets grown was quite remarkable, and this did much to make up the loss to the farmer in the gross weight of beets. Beet diseases were quite noticeable throughout the district. The main feature of the year's work was the establishment by the company of large feeding yards adjacent to the factory. These yards were stocked with cattle and fed from the pulp produced by it. The factory began slicing August 15. Owing to the limited supply of beets it was decided to use but half of the capacity for working them. In working on this half-capacity run the factory several times reached 1,100 tons of beets daily.

Results at Oxnard during the year 1900.

Date of commencing factory operations		15th of August
Date of closing same		18th of October
Number of days operating		60
Number of acres planted to beets		7,184
Number of acres of beets harvested		6,238
Quantity of beets worked	tons	66,886
Average cost of beets per ton		$5.01
Average yield of beets per acre	tons	10¾
Average sugar content of beets worked	per cent	18
Average coefficient of purity		81
Amount of sugar produced[1]	tons	9,696.45
Sugar in process	do	348.9
Average number of employees for the campaign		592

[1] Including product from purchased molasses.

SALINAS.—The Spreckles Sugar Company is operating a factory here of 3,000 tons daily capacity. The Salinas district, probably more than any other, had to contend with the diseases affecting the sugar-beet crop during the past year. The consequences of the root blight or rot were far-reaching, both as to its present effects and the alarm it has aroused as to consequences in the future. The factory requires a large tonnage of sugar beets daily for its work. It has the largest working capacity of any factory in the world, namely 3,000 tons.

Irrigation was tried quite extensively in different sections during the past year with very favorable results. With the present favorable crop prospects and no recurrence of the beet disease, this district will have a large area in beets for 1901. After the next crop it will be possible to know something of the effect which a diseased crop will have on the succeeding crop of beets on the same land.

SANTA MARIA.—The Union Sugar Company is operating a factory here of 500 tons daily capacity. The climatic conditions affecting the beets grown in this section were quite similar to those described for other factories in southern California. The acreage was not nearly so large or the tonnage so good as had been anticipated. The factory began its campaign about September 10 and closed about November 10.

The company is taking the same steps to solve the question of the future supply of beets as are being taken by several other companies in California. It is getting control of large tracts of land, which it leases to growers. The factory was originally designed with a view of increasing the working capacity to 1,000 tons. Up to date it seems able only to supply itself with about 350 tons daily for short campaigns. Plans were matured, however, for securing a supply of beets in the future and running the factory at the 1,000-ton capacity for a longer campaign.

CROCKETT.—The California and Hawaiian Sugar Refining Company is operating a factory here of 1,000 tons daily capacity. This factory is designed to refine sugar in addition to manufacturing sugar from beets. The supply of beets this year was not very large. It was estimated to be about 10,000 tons, which gave it but a short campaign.

Results at Crockett during the year 1900.

Date of commencement of campaign		1st of August
Date of closing same		15th of October
Number of days factory was in actual operation		15
Number of acres planted to beets		5,800
Number of acres of beets harvested		2,500
Quantity of beets worked	tons	8,704.56
Average yield of beets per acre	do	3.5
Average sugar content of beets worked	per cent	19.39
Average coefficient of purity		81.6
Quantity of sugar produced	tons	1,328.7
Number of employees during the campaign		125

ALVARADO AND WATSONVILLE.—At Alvarado, Cal., the Alameda Sugar Company is operating a factory of 800 tons daily capacity, and at Watsonville the Western Beet Sugar Company is operating a factory of 1,000 tons daily capacity.

These two concerns are the oldest and most successfully operated sugar factories in the State. It has been impossible to get specific details with reference to the history of last year's work. The factory at Watsonville sent its beets in 1899 to Salinas to be worked up. It belongs to the same company as the Salinas factory.

It is understood that in 1900 fairly good crops were raised for both the Alvarado and the Watsonville factories. And it has further been announced on good authority that the Watsonville factory worked up its own supply of beets grown the past season. The bountiful supply of rainfall and snow during the winter has assured an abundant supply of beets for operating these factories in 1901.

IN COLORADO.

Colorado is a recent acquisition to the list of States manufacturing sugar. It has one factory that has operated for two years, and two others that have worked through one campaign. These factories are located at Grand Junction, Rocky Ford, and Sugar City. The State is to have one more factory (possibly two) to engage in the manufacture of sugar in 1901. The special feature of Colorado's sugar production is that the beets are grown almost entirely by irrigation. It has been shown so far as the factories already installed in the State have operated that there are many advantages in the peculiar conditions that prevail, and that it has large tracts of land quite similar to the districts now being tested by these sugar factories. It is very probable that with their success many more will be installed in the State. The beets grown during the past year were very high in their sugar content and purity, averaging throughout the campaign in one instance over 17 per cent sugar. It is the peculiar advantage of these valleys that rain rarely falls after a certain time in the growing season of the beets. After the crop has been produced by irrigation it can be allowed to remain in the soil and ripen unaffected by rain. This gives a better opportunity to control the size and the ripening of the beets and makes it possible to force an early harvest. It also avoids more or less the necessity of siloing or harvesting until beets can be delivered, except where it becomes necessary to avoid freezing.

One of the experiments tried in Colorado with favorable results was the growing of sugar beets as the first crop on new land. The conditions of farming surrounding the three factories already installed are very much the same. Fruit, vegetables, and alfalfa have been the principal crops previous to the introduction of sugar beets. This new crop adds value to the valleys in that it increases their crop resources and offers a better opportunity for a system of rotation.

GRAND JUNCTION.—The Colorado Sugar Manufacturing Company of this place has installed a factory of 350 tons capacity. Grand Junction is situated in a fruit district in the Grand River Valley. This section has established a reputation for producing a high quality of the different deciduous fruits. During the two seasons that beets have been grown for the factory it has been demonstrated that the soil will produce beets of high quality. This company has done the pioneer work of sugar-beet growing for the State; it has had to study out the methods of successfully growing this crop under the peculiar conditions that exist; in doing this it has met many adverse influences and shouldered the results of much experience. New factories starting in the State can naturally take advantage of facts that have been already determined, and it is probable that no other factory will have to contend with as much as this one did in the beginning. The results of the past year are a great improvement over the one previous. It was found almost impossible from the beginning to secure sufficient previously cultivated ground upon which to grow the crop of beets, most of the lands in the district that have been under cultivation for any length of time having been devoted to growing alfalfa and other well-known crops, or they had been planted in orchards, upon the profitableness of which the people of the district had learned to rely.

For the first year much of the crop of sugar beets was grown between the rows of these young fruit trees, and the double purpose was served of growing the crop and cultivating the young trees. This was found a process not adapted to producing the best beets. In many other instances the attempt was made to reclaim new land by using sugar beets as a first crop. The application of water by irrigation to this new crop was not well understood at this time. The first year there was quite a serious attack by insects. The two years' experience that the factory has passed through will greatly benefit the growers of sugar-beets for this factory and others that will be established in the State from time to time.

The factory started up about September 20, 1900, working its brown sugars left over from the previous campaign, and began slicing beets about October 1. The beets grown in the district were quite high in sugar content and purity, the average in sugar being over 16 per cent, with a purity coefficient of about 83. Farmers received $4.25 per ton for their beets running from 12 to 15 per cent sugar, and 25 cents additional for each additional per cent or fraction thereof. We clip from the Sugar Beet a new schedule of prices offered by this company, as follows:

	Per ton.
Beets with 22 per cent sugar	$7.58⅓
Beets with 21 per cent sugar	7.25
Beets with 20 per cent sugar	6.91½
Beets with 19 per cent sugar	6.58⅓
Beets with 18 per cent sugar	6.25

	Per ton.
Beets with 17 per cent sugar	$5.91⅔
Beets with 16 per cent sugar	5.58⅓
Beets with 15 per cent sugar	5.25
Beets with 14 per cent sugar	4.91⅔
Beets with 13 per cent sugar	4.58⅓
Beets with 12 per cent sugar	4.25

SUGAR CITY.—The National Sugar Company is operating a factory at this place of 500 tons daily capacity. The factory began its campaign November 15, 1900. This was its first campaign, and the showing made is a wonderful proof of the resourcefulness of the Arkansas Valley for growing sugar beets. Many of the fields were planted on new and untried land. The results were a very high sugar content and a fairly good tonnage per acre.

ROCKYFORD.—The American Beet Sugar Company is operating a factory at this place having 1,000 tons daily capacity. It began slicing beets October 11, 1900. It is probable that the results obtained by the farming community growing beets for this factory are more typical of what can be accomplished in the Arkansas Valley than those given for Sugar City (which is near), from the fact that conditions are more settled and favorable for producing beets. It is certain that no other district in the United States has ever attained such high success in growing beets for the first time as this one has. In fact the results would rival the best attained by any other factory district in its most favored years. The sugar content of the beets was very high and the tonnage grown per acre was everything that could be desired.

The high content of the sugar made the growing of the crop quite profitable to the farmers, since beets showing this high percentage are worth $5 per ton. There is nothing in the system of agriculture prevailing in this district necessitating an unusual expense in producing the crop; and yet it seems possible from the present year's results that the district will be able to average as high as 15 tons during ordinary years. With this high quality of the beet, the farmer will receive $5 per ton for his beets, giving, according to this estimate, about $75 per acre, a net profit of at least $45 per acre. These results probably reach the high-water mark of favorable showing that this industry has made in this country up to date.

Results at Rockyford during the year 1900.

Date of commencing factory operations	14th of October
Date of closing same	9th of December
Number of days operating	60
Number of acres planted to beets	5,635
Number of acres of beets harvested	4,530
Quantity of beets worked ..... tons..	41,656
Average cost of beets per ton	$4.76
Average yield of beets per acre ..... tons..	9.77

Average sugar content of beets worked	per cent	16.41
Average coefficient of purity		83.6
Amount of sugar produced	tons	4,491.75
Sugar in process	do	106
Number of employees for the campaign		425

IN ILLINOIS.

PEKIN.—The Illinois Sugar Refining Company is operating a factory at this place, having a working capacity of 700 tons. This factory has gone through two campaigns, both of which can be pronounced quite successful, considering that they are the opening or experimental years of the factory. This State started in the manufacture of sugar from sugar beets over one-third of a century ago. A factory was built at Champaign. After leading a precarious existence of two or three years it was finally taken down and removed to some other locality. It seemed that the time was not ripe for introducing the sugar industry at that time. The perfection of the process and the conditions of manufacture that obtained at that time in manufacturing sugar from beets were not such as to combine with the system of agriculture then in vogue in Illinois. The system of farming was too crude to take up with a branch of agriculture that was so intensive. Wild land could be had farther west for a merely nominal sum; the public domain was open for free grazing. Only such things were produced as could be raised with the least effort. Farming meant the production of hogs, cattle, corn, wheat, and oats. Now the situation is changed. The range has gone farther west; the land has become valuable, and it must be made to produce those things that will give the greatest returns from small acreage. The farmer is the copartner with the manufacturer of prepared meats, poultry, butter, cheese, and canned fruits and vegetables. As a feature of this era of intensive farming, comes the sugar industry. The same number of acres provides employment for many times the same amount of labor. The history of civilization is repeated. As a community becomes older it becomes more populous and more intensive in its system of industries; it must provide for more and more employment and at the same time adjust itself to a system of production that can compensate this extra labor and give a fair return to the producer.

Illinois, in commencing her second attempt at installing the sugar industry, has reached this period. She has one factory that is demonstrating its usefulness to the agricultural and commercial classes of the State. She has many more localities that are equally fitted for installing this industry, localities that have been thoroughly tested by the State agricultural experiment station and local organizations. Many of these places are on the eve of effecting organization, and capitalizing and constructing factories. It can be but a little while until Illinois will be taking advantage of these many opportunities that

exist in the State and, along with the State o Michigan, will enter the field in earnest, manufacturing sugar and supplying the great demand for this product. There is abundant capital in the State seeking employment to build the factories when it becomes apparent that there is profit in doing so. An early day will see the installation of many of these plants, the smoke from whose stacks will indicate that the coal of the State is being consumed in working up a product from her own farms, giving employment to home labor and yielding a product for home consumption.

The factory at Pekin is working the beets from about 5,000 acres, and is distributing to the farmers over $200,000 annually. The year 1900 has been quite dry and the crop has not been all that could be desired; yet there has been enough even in the two unfavorable years to convince the farmers of the great advantage of living in the vicinity of a sugar factory and possessing the privilege of producing beets for the same.

IN MICHIGAN.

The showing of the sugar industry in Michigan has very much improved through the results of the past season. Climatic conditions throughout the State have been very good. Farmers have gone into the work of this year with considerable more intelligent effort. The results are that all the factories have been working on a very much increased supply of beets which show a great improvement in their sugar content and purity. Where the campaign of 1899 closed with almost complete discouragement, now everyone is feeling highly pleased with the showing made. The work thrown on this State in one season of installing nine sugar factories and growing the beets for them was a tremendous strain on its resources. The farmers were entirely unacquainted with the subject. They did not know how to take advantage of favorable conditions or to ward off the effects of unfavorable ones.

In 1899 the parties connected with the factories were too much interested in building them, in installing the machinery, and getting everything in readiness to give any attention to the growing of the beets. The feeling seemed to prevail among the agricultural classes of the State that sugar beets as a crop would succeed on any kind of land. In many instances lands were planted in sugar beets that had been a failure for some years in producing any other kind of crop. The most valuable result of that year's work was the accumulation of experience.

Farmers were prepared to plant their crop of sugar beets for 1900 with considerable more wisdom. The factories installed regular agriculturists to supervise and aid the farmers and to bring the two classes into closer harmony and union of interests. The conditions for growing sugar beets have been excellent. The results have been very favorable and encouraging. With the experience of the last two years, it can be safely counted that Michigan has launched in a career of suc-

cessful sugar production. It has more factories than any other State. The indications are that more new factories will be started in Michigan than in any other State in the near future. From the Sugar Beet is clipped the following condensed statement showing the results in Michigan during the past year:

As the campaign in Michigan is drawing to a close, an estimate may be made of the total output of all the factories that were in operation. This estimate would put the figures at 50,000,000 pounds, or 25,000 tons of sugar turned out. The farmers of Michigan have raised 250,000 tons of beets, for which they have received, in round numbers, $1,000,000.

The companies whose factories have been in operation this campaign and the approximate amounts of sugar turned out by each are as follows:

Estimated product of sugar by Michigan factories for 1900.

	Pounds.
Michigan Sugar Company, Bay City	6,670,000
Bay City Sugar Company	12,000,000
West Bay City Sugar Company	5,700,000
Wolverine Sugar Company, of Benton Harbor	1,031,265
Alma Beet Sugar Company	7,000,000
Holland Sugar Company	9,000,000
Kalamazoo Beet Sugar Company	1,500,000
Peninsular Sugar Refining Company	7,000,000

This gives a total of approximately 50,000,000 pounds, to which must be added the output of the Marine Sugar Company, of Marine City, Mich., which began its campaign December 18 and has a working capacity of 300 tons of beets per day.

It will be interesting, for the purposes of comparison with the above output during the past year, to examine the results at the same factories for the previous year. This will show the improvement that has taken place in Michigan after a year's experience and during a season that was more nearly normal in its crop conditions. The following figures are taken from the fifty-eighth annual report of the commissioner of the land office of the State of Michigan. They are compiled from the returns made from the factories to this office on their output and upon which they based their claims for the bounty of 1 cent per pound under the then existing law of the State:

Product of sugar by Michigan factories for 1899.

	Pounds.
Michigan Sugar Company	7,415,233
Bay City Sugar Company	6,942,132
West Bay City Sugar Company	2,095,808
Alma Sugar Company	3,359,368
Kalamazoo Sugar Company	1,440,598
Wolverine Sugar Company	1,701,082
Holland Sugar Company	2,461,919
Detroit Sugar Company	3,669,839
Peninsular Sugar Refining Company	4,064,894
Total	33,150,873

Total tons, 16,575.

The conditions in the State were so very similar throughout the various sections where factories are located that it will be unnecessary to describe them in connection with any particular factory. The supply of beets in each case was highly satisfactory and their quality was good.

Bay City.—This factory, built by the Michigan Sugar Company, was the first started in the State, consequently the campaign of 1900 was its third. The factory started up on the 4th day of October. It has put in operation the osmose system of treating molasses; in fact, it has made quite a number of improvements since the first year. Statistics of the year's work are not yet fully completed, but every indication points to the fact that the farmers have very much increased their tonnage per acre, and that sugar-beet growing has been a very profitable enterprise for the season. In quality, the beets are higher than any grown before.

The Bay City Sugar Company has constructed a factory at this place side by side with the one mentioned above. It has a daily capacity for working 600 tons of beets. Its supply of beets was very much increased and improved in quality over that for the previous campaign.

West Bay City.—The West Bay City Sugar Company is operating a factory at this place having a daily capacity of 500 tons. This factory was completed late in 1899, and had a limited supply of beets for the first year's campaign. In 1900 the supply of beets was a great deal more abundant, and the factory was able to test its resources more effectually.

Alma.—The Alma Sugar Company is operating a factory at this place having a capacity of 500 tons daily. It secured an abundant supply of good beets, and started early on its contracts with the farmers for the supply for next campaign. The results of this year's work have convinced the farmers that sugar beets are a profitable crop, and they are showing their appreciation of this fact by readily entering into contracts with the factory for furnishing its next year's supply.

Results at Alma for the year 1900.

Date of commencing factory operations		15th of October
Date of closing same		24th of December
Number of days actually in operation		64
Number of acres planted to beets		3,200
Number of acres of beets harvested		3,200
Quantity of beets worked	tons	32,800
Average cost of beets per ton		$5.33
Average yield of beets per acre	tons	10.25
Average sugar content of beets worked	per cent	14.5
Average coefficient of purity		83.47
Amount of sugar produced	tons	3,500
Average number of employees for the campaign		275

KALAMAZOO.—The Kalamazoo Beet Sugar Company is operating a factory at this place having a capacity of 500 tons daily. It began its campaign October 9, 1900, with a large crop of beets ready. The yield per acre was about half as large again as that of last year, and the farmers demonstrated that they could reduce the cost of production for the second year's crop almost 50 per cent. They also received considerable advance over the price of last year's beets.

BENTON HARBOR.—The Wolverine Sugar Company is operating a factory at this place having a daily capacity of 350 tons. It began its campaign October 25, 1900. The supply of beets for the factory was very much increased and the quality of the same greatly improved. The supply for the campaign was very much less, however, than it should have been. The factory closed down December 19 after a run of twenty-seven days, slicing 7,000 tons of beets.

The company will make an energetic effort to better the situation for next campaign. It is offering 50 cents per ton advance over the previous price. The factory has had more or less trouble in securing a supply of beets during the past two years. Farmers have not taken hold of the proposition as actively as in other places in Michigan. It is confidently expected that the advance in price and the extra effort the factory is making to get a supply will put it in position to run a full campaign next year as well as a successful one.

HOLLAND.—The Holland Sugar Company is operating a factory at this place having a daily capacity of 350 tons of beets. This is one of the places that was especially mentioned last year as growing beets upon inferior or worn-out soils to a considerable extent. In making their plans for the season of 1900 the sugar-beet growers made better selections. The average tonnage of the beets produced in this section shows that sugar-beet growing is profitable. In cases where the best lands were selected and careful attention was given to the cultivation of the crop, results were secured that can not be excelled or equaled with any other crop on the farm.

The factory worked up about 19,000 tons of beets, and paid the farmers therefor about $85,000. The acreage planted was slightly over half what it was the previous year, but the supply of beets was about 500 tons greater. The results were so favorable to those participating in growing the beets that the farmers are anxious to renew the experiment and are readily making contracts for next year's supply.

Results at Holland during the year 1900.

Date of commencing factory operations	15th of October
Date of closing same	24th of December
Number of days operating	62
Number of acres planted to beets	2,000
Number of acres of beets harvested	1,800
Quantity of beets worked tons	17,242

Average cost of beets per ton	$4.90
Average yield of beets per acre.....tons..	9.5
Average sugar content of beets worked .....per cent.	12.5
Average coefficient of purity	82.6
Amount of sugar produced .....tons..	1,673.7
Sugar in process .....do...	75
Number of employees for the campaign	120

ROCHESTER.—The Detroit Sugar Company has constructed a factory at this place having a daily capacity of 500 tons. On October 19, 1900, it began its second campaign. The beets grown in the vicinity showed a considerable increase in the tonnage per acre and sugar content. The factory closed December 20, being in operation about two months.

The acreage was considerably less than that of the year previous, but the output of sugar was a little greater. It was a favorable year for growing the beets, and the results were quite encouraging. The farmers are entering readily into contracts, and the supply for next campaign will be considerably increased.

CARO.—The Peninsular Sugar Refining Company is operating a factory at this place having a daily capacity of 600 tons of beets. It started on its campaign October 18, 1900. It is using the Steffin process in securing the sugar from the molasses. The company has been at considerable expense revising and improving its factory after the first year's run. The results of growing the beets in this vicinity have been very encouraging. The average tonnage is high, the sugar quality of the beet is good. The campaign was closed about December 25, so far as working beets was concerned. About 25,000 tons of beets were worked during the run, and the farmers in that section received about $110,000 for the same.

The experience of this factory during its first year's run, so far as the amount and quality of the beets were concerned, was much more encouraging than that of any other factory in the State. This was on account of the excellent and intelligent supervision on the part of the agriculturist of the factory. The results for 1900 have shown quite an improvement over those for 1899, and the two years have given the farmers every indication that the factory is in position to aid them materially and profitably. The main drawback has been in the working of the factory itself. It has been very carefully revised and improved and it is one of the most successful plants in the State.

MARINE CITY.—The Marine Sugar Company established a factory at this place with a working capacity of 350 tons of beets daily, making its first run the past season (1900). The farming community furnishing the beets for this factory had the benefit of the experience of the State in growing sugar beets for the other factories the year before. It is the latest factory constructed in the State. For the first year's experience the beets were exceptionally good in quality and quantity, and the farmers were highly encouraged with the results of the crop.

Some trouble was experienced in a few fields' being overrun with the army worm, which came onto the beets from other adjoining crops. No material damage was done, however. The farmers learned that the beet crop is subject to attack by this pest, studied methods for warding it off, and will be prepared for such emergencies in the future. Along with the other beet-growing districts, this one enjoyed the normal conditions for sugar-beet growing that prevailed throughout the State, and the farmers are better prepared, and more inclined, to engage in sugar-beet growing in the future.

IN MINNESOTA.

St. Louis Park.—The Minnesota Sugar Company is operating a factory at this place of 400 tons daily capacity. Minnesota experienced an unprecedented drought during the early part of the summer. At a time when the beets needed rain most for germination and for starting them on a vigorous growth it was very dry. In many fields the beets failed to come up, or did not come up in sufficient numbers to insure a stand. Reseeding was resorted to in many cases, and with quite good results. These second plantings were necessarily late, but not infrequently they produced a good supply of beets of good quality.

As a rule, where the beets did not materialize by the middle of June, the farmers plowed up the ground and put it in something else. There is this encouragement to be derived from the situation in Minnesota, however: The main crops upon which the State relied for years were a partial failure. This was especially true of the northern half of the State. Flax fared considerably better. Comparing the beet crop with these, much can be claimed for its success, as the yield was very much better. In fact, in most of the fields the sugar beets were good where a stand was secured in the spring, and the farmers continued to cultivate the crop. During the season the beets were not attacked by any diseases or insects.

The campaign opened up about October 6 and closed December 2, lasting fifty-eight days, about half the time that it should have operated under normal conditions.

Results at St. Louis Park during the year 1900.

Date of commencing factory operations		6th of October
Date of closing same		2d of December
Number of days operating		58
Number of acres planted to beets		3,000
Number of acres of beets harvested		1,900
Quantity of beets worked	tons	18,500
Average cost of beets per ton		$4.85
Average yield of beets per acre	tons	10
Average sugar content of beets worked	per cent	11
Average coefficient of purity		80
Amount of sugar produced	tons	1,328.2
Sugar in process	do	130
Number of employees for the campaign		250

IN NEBRASKA.

The general conditions for growing sugar beets in the State were not very favorable during the past year. In the early part of the summer indications were that a good crop would be produced, and the sugar interests were looking forward to a successful campaign in sugar making.

In the latter part of July there was an intensely hot spell that lasted up to the second week in August. After this the beets were injuriously affected in several ways, which resulted in material loss to the farmers growing them. In some cases the beets would wither up and become woody, also quite flexible and leathery; in other cases a rot would begin with the taproot following it up until the entire beet was consumed and stood a rotten mass in the ground; in still others the rot would begin at the crown and consume the beet from the top downward.

This period of misfortune was followed in the fall by one of excessive and prolonged rainfall which interfered with the ripening of the beets. All these tendencies materially affected the sugar content and the tonnage per acre. So it can be said that the sugar-beet crop in Nebraska during the past year was far from a normal one.

AMES.—The Standard Beet Sugar Company has a factory at this place of 500 tons daily capacity. The sugar beets are grown here on the rich, heavy bottom lands, while at Grand Island and Norfolk the beets are grown more on upland or sandy soils.

In 1900 the Standard Cattle Company of this place alone grew 2,000 acres of the beets, a little more than one-third of the factory's entire supply of beets.

This is the second year's run for the factory and conditions have not been normal during either year. At seeding time it was quite dry and unfavorable to germination. This was followed in the latter part of July and August with intensely hot weather. The latter part of the season during September and October when the beets should have been ripening, there was a heavy rainfall and a prolonged wet season. The beets were slow to ripen, which retarded the commencement of the campaign. The excessive wet kept the beets growing and was probably beneficial in causing a larger tonnage than might have been otherwise.

Following the hot spell in the summer the beets in this section were very badly afflicted with what has been commonly termed "leaf blight," "leaf spot," and "root blight." It seemed that all of these troubles were more or less present. Indications were that a single beet would be affected by all three of these. I examined many fields during the latter part of September and noted the prevalence of these diseases. Reports from there afterwards seemed to indicate that the growing spell engendered by the late rains had a tendency to correct some of

the bad effects of the preceding unfavorable conditions, and that beets only slightly affected regained more or less their normal condition.

Under the head of "Insects and diseases" (p. 68) is given a review of these troubles, made by a competent person on the ground during their prevalence.

Results at Ames during the year 1900.

Date of commencing factory operations		6th of October
Date of closing same		10th of January
Number of days operating		102
Number of acres planted to beets		4,267
Number of acres of beets harvested		4,055
Quantity of beets worked	tons	36,440
Average cost of beets per ton		$3.90
Average yield of beets per acre	tons	9
Average sugar content of beets worked	per cent	9.59
Average coefficient of purity		71.91
Amount of sugar produced	tons	2,459
Sugar in process	do	199.2
Number of employees during the campaign		265

GRAND ISLAND.—The American Beet Sugar Company has been operating a factory at this place for several years. This factory has a capacity of 350 tons per day. The season started in quite favorable, and in June the indications were that a good crop would be secured. In the latter part of July and early August an unprecedented hot spell prevailed. This was followed by the sugar-beet diseases that have been in evidence in several sections. They were especially severe in the beet fields surrounding Grand Island.

I went through a great many fields during the latter part of September. I estimated that the loss from beets already dead was over half the crop, and the rest of the beets were more or less affected. The factory at this place did not open up during the campaign, but shipped its beets to Norfolk, where the company has another factory.

Results at Grand Island during the year 1900.

Number of acres planted to beets		2,409
Number of acres of beets harvested		1,870
Quantity of beets worked (shipped to Norfolk)	tons	12,857
Average cost of beets per ton		$3.68
Average yield of beets per acre	tons	6.82
Average sugar content of beets worked	per cent	12.4
Average coefficient of purity		79

NORFOLK.—The American Beet Sugar Company has a factory here of 350 tons daily capacity. The climatic conditions were very similar to those described for Grand Island and Ames. The beets were attacked by disease here, but the bad effects were not so pronounced as at Grand Island, probably owing to the fact that the soils are much better able to withstand the effects of drought.

The factory worked up the crop of beets grown at Grand Island along with the beets grown for this factory. It began operations October 8 and closed December 20, having a campaign of seventy days. In the beginning the beets showed a low percentage of sugar. It seems the factory owners realized that some concessions must be made to keep up the interest of the farmers, as they were likely to be discouraged with the results of the crop. So the following order was issued:

Owing to the fact that in some localities the beets are testing considerably below standard, which is undoubtedly due to the continued heavy rainfall, we have decided to vary from the established contract prices as follows:

The purity will not be considered in determining the price, it being based on sugar content entirely. The 15 per cent deduction for each per cent or fraction thereof of purity will therefore not be made. This means that a beet testing 12 per cent sugar with a purity below 78 per cent will still be a $4 beet, and likewise on lower grades the purity will not affect the price as determined by the sugar.

Beets testing below 10 per cent sugar and 73 per cent purity will be received if the sugar content is not so low that it is absolutely impossible to use them in the factory. Appreciating the fact that, at a price of less than $3 per ton, the returns would be insufficient to cover the cost of production, that shall be the minimum price, and any beets that it will be possible to work will be received at that figure. These changes, of course, favor the grower and are made because the season has been very unfavorable so far as ripening the crop is concerned.

Results at Norfolk during the year 1900.

Date of commencing factory operations		9th of October
Date of closing same		17th of December
Number of days factory was in operation		68
Number of acres planted to beets		1,853
Number of acres of beets harvested		1,800
Quantity of beets worked[1]	tons	26,038.9
Average cost of beets per ton		$4.88
Average yield of beets per acre	tons	8
Average sugar content of beets worked	per cent	11.7
Average coefficient of purity		77.9
Amount of sugar produced	tons	2,314.45
Sugar in process	do	101.4
Number of employees during the campaign		215

IN NEW MEXICO.

CARLSBAD.—The Pecos Valley Beet Sugar Company has been operating a factory here having a capacity of 200 tons daily. The beets grown for the factory receive their moisture entirely through irrigation. The water is taken from the Pecos River, a branch of the Rio Grande. The factory has been in operation for several years.

One of the difficulties of this section is that it has not been able to grow a sufficient variety of field crops in order to carry out a practical rotation. Alfalfa is the principal crop outside of sugar beets. The section has succeeded well in vegetables and fruits, especially grapes

[1] Including beets shipped from Grand Island.

and deciduous fruits; but fruit is not a product that can be practically brought into rotation with field crops.

The fields of sugar beets during the past two or three seasons have been very much affected with what is termed "black root rot." The effect of this was quite discouraging to the farmers and factory. After mature deliberation on the subject it was finally considered best to discontinue the growing of sugar beets for a while and plant the lands in something else. It was thought by some also that the trouble with the beets was from lack of nitrogen in the soil. It was therefore considered advisable to reinvigorate it by growing one of the legumes, and the land was largely sown to alfalfa, it having been previously demonstrated that this is an available crop in that section.

IN NEW YORK.

The development of the agricultural industries of the West has produced a competition from which the farmers of the East have suffered. The farmers of the West engaged in the production of meats, butter, eggs, and poultry; and they were able to place these products in the Eastern markets at a lower figure than that at which the New York farmer with his high-priced land, expensive labor, and expensive tillage, could afford to produce them. This forced the Eastern farmer to study the intensive side of agricultural production. Canneries of all kinds were introduced, also butter and cheese factories. The production of sugar appealed to this section as an industry peculiarly fitted to its conditions.

ROME.—The First New York Sugar Company operates a factory here of 200 tons daily capacity. This factory started up about three years ago. It is one of foreign make and small capacity. It was originally designed to work about 200 tons of beets per day but never came up to that record in actual work. It has since been overhauled and very much improved.

For some reason the farmers did not give the cultivation of sugar beets sufficient attention to become accustomed to the benefits of growing the crop. The factory made a mistake the first year in the quality of its seed and the beets were low in sugar and purity. This had a disheartening tendency and it seems that it has been impossible to work up enough enthusiasm among the farmers to keep the factory supplied with beets for any length of time. The results are that the industry never has had a good test in the community. It is reported that there is a plan on foot to reorganize this company and start the factory on a career of usefulness in the near future.

BINGHAMTON.—The Binghamton Beet Sugar Company is operating a factory here of 350 tons daily capacity. This factory started in with every indication of success. The farmers seemed determined to give sugar-beet raising a thorough test. The early part of the season

of 1900 was quite dry. This was followed by good rains in June, and the season on the whole was fairly favorable for the production of a crop. The supply of beets for the factory was increased about half over that of the previous year.

Experience is telling in favor of the production of sugar beets in the farming districts available to this factory. They are grown in an area surrounding the factory having a radius of about 75 miles. The larger farmers, or those putting in the largest acreage of beets, have had much the best success in raising the crop, showing that responsibility is a feature in growing this crop. The small farmers who grew them as a sort of experiment or an incidental crop have not done so well. But it is upon the showing made by the farmers who have grown them as a crop and expended sufficient labor and money to produce them that the results must be judged. Fortunately no sugar-beet disease worth mentioning appeared in this district, and insects were no more active than is usual with growing crops.

The factory is able to dispose of its pulp as fast as it is produced at 50 cents per ton; it is taken generally by farmers returning home after delivering beets; but considerable pulp is shipped out in carload lots. On guaranteed contracts the factory can realize $1 per ton. It seems evident that it is only a question of a short time when this factory will be able to dispose of all its pulp at this figure.

The factory began operations October 8 and closed about the middle of January.

Results at Binghamton during the year 1900.

Date of commencement of factory operations		8th of October
Number of acres planted to beets		2,200
Number of acres of beets harvested		1,900
Quantity of beets worked	tons	19,009
Average cost of beets per ton		$5.00
Average yield of beets per acre	tons	10
Average sugar content of beets worked	per cent	13
Average coefficient of purity		81
Amount of sugar produced	tons	1,160
Sugar in process	do	90
Number of employees during the campaign		120

Lyons.—The Empire State Sugar Company is operating a factory here of 600 tons daily capacity. Last year (1900) was its first campaign. It made contracts with the farmers for about 5,000 acres of beets. Several hundred acres had been grown in the county during previous years for the factories at Rome and Binghamton. The season was very good, and the beets produced were considerably above the average tonnage of localities growing beets for the first time. The average sugar content and purity ranged above the requirement for factory purposes. The experience this year indicates that everything is favorable, and with the knowledge already derived, the factory

will be able to sustain itself and mark out a career of usefulness in the sugar industry.

Results at Lyons during the year 1900.

Date of commencement of factory operations	16th of October
Date of closing same	25th of January
Number of days operating	101
Number of acres of beets planted	4,300
Number of acres harvested	4,000
Quantity of beets worked	tons.. 35,000
Average cost of beets per ton	$5.00
Average yield of beets per acre	tons.. 8.75
Average sugar content of beets worked	per cent.. 12.8
Average coefficient of purity	81.9
Amount of sugar produced	tons.. 2,500
Number of employees during the campaign	150

IN OHIO.

FREMONT.—The Continental Sugar Company is operating a factory here of 350 tons daily capacity. This section had grown beets more or less in a practical way during the season of 1899. The season of 1900, or the growing part of it, was very favorable to the growth of this crop. In making the selection of land upon which to plant the beets, the farmers in many instances made the mistake that characterized Michigan's first attempt. The farming section is an old one and the lands have been in cultivation a good while. Many of them are becoming quite exhausted of their native fertility. The impression prevailed that sugar beets were a crop that would thrive on these exhausted lands. The error was discovered, however, by the year's experience, and the section will show much better results in the future. Better selections of land will be made next year.

A fair tonnage was produced, considerably better than that shown in Michigan's first attempt, owing to the fact that climatic conditions were better and farmers knew more about the crop than did those of Michigan during their first attempt. The company really experienced more difficulty than the farmers. The fall rains were excessive. They continued to a later period than usual. The beets were kept growing and not allowed to ripen. This helped the tonnage of the farmers, but lowered the sugar content of the beets. The results were sufficient to encourage the farmers to continue the enterprise, and the factory will undoubtedly have a sufficient supply for its next campaign. With better climatic conditions and with the experience of last year's effort, beets will be grown cheaper and better in every way.

The enterprise can be congratulated on having passed its experimental year with quite favorable results. It has put Ohio in the list of sugar-producing States. There are many districts in the State where this industry can be established; there is a large local demand

for this product, cheap transportation, a fine quality of coal, and all other facilities for cheap production. It must be looked upon as a State promising much in the future development of the sugar industry.

The factory began its campaign October 26, 1900, and worked up the beets grown on about 2,500 acres.

IN OREGON.

LAGRANDE.—The Oregon Sugar Company established a factory at this place having a daily capacity of 350 tons. This is the only factory in the State, and it made its third campaign in 1900. Oregon was one of the leading States in investigating its conditions for producing sugar beets. Its experiments have been continuous for a series of years. It has been clearly shown that there are several sections in the State well adapted to the establishment of this industry, but none of them up to this time have taken advantage of these conditions except Union County, where this factory is located. The matter has been agitated in other places; partial organizations have been effected, but without material results.

The factory at Lagrande has been laboring under more or less adverse conditions from the beginning. Along with the rest of the coast region, it has been experiencing a continuous and unprecedented period of drought, covering three years. There has not been as much continuous dry weather for many years. The factory was constructed soon after the period began and has never had the opportunity to show the results that might be attained under normal conditions. The farmers hoped each year that these conditions would return, and sugar beets were planted along with other crops only to be followed successively with inferior returns. Everything points to more favorable prospects for 1901; rains and snows have been copious, and they are looking forward to a more prosperous year.

Another backset to the growing of sugar beets resulted from the attempt of the farmers to grow beets on tracts too large for beginners. It was found that the amount of labor required and the cost of production far exceeded those of any other crop to which they were accustomed. This had a discouraging tendency. Those interested in growing sugar beets in any new locality should encourage the planting of smaller fields. After the farmer has grown them for two or three seasons he discovers what the requirements will be in the way of labor, etc., and then he can increase his acreage as his experience and resources fit him to perform the task. He should begin on the smaller plats and work up to the larger ones through a series of years, and not follow a reverse process, as it is feared has been the tendency at Lagrande.

This locality has also suffered more or less from lack of sufficient

and qualified laborers to take care of and harvest the sugar-beet cr
An attempt was made during the last growing season to bring in a l
of Japanese in order to fill this demand. The past season has bee
quite dry and unfavorable, but on harvesting the crop it was found that the beets were better in quantity and quality than had been anticipated. The factory itself has been thoroughly revised and put in shape for taking care of a sufficient supply of beets when the climatic conditions shall be more favorable. It began its campaign October 1. Many good yields have been reported and the average is fairly good.

Results at Lagrande during the year 1900.

Date of commencing factory operations	1st of October
Date of closing same	5th of November
Number of days operating	36
Number of acres planted to beets	1,803
Number of acres of beets harvested	1,760
Quantity of beets worked, tons	9,097
Average cost of beets per ton	$4.50
Average yield of beets per acre, tons	5
Average sugar content of beets worked, per cent	14.2
Average coefficient of purity	84.1
Amount of sugar produced, tons	994.9
Sugar in process, bags	800
Number of employees for the campaign	150

IN UTAH.

The climatic conditions were very unfavorable for growing sugar beets or, in fact, any other crop in Utah during the past year. While the growing of sugar beets is accomplished largely through irrigation, yet irrigation is dependent on the amount of rain and snow which falls in the mountains in the winter. Especially is it dependent upon the snowfall, since this melts gradually and moves down the streams and is conducted out into the irrigating ditches and turned onto the fields during the growing season. The snowfall in Utah was unprecedentedly light, and the State has not suffered in drought so much in thirty years.

The State has grown beets so long and its resources for producing them are so well known that it may be considered as established that drought, disease, and insect pests are about the only things that can cut off an assured crop. During the past season the injurious influences which affected the beets in other sections were not felt in this State, only in a small way hardly worth mentioning. Up to the present time there has been no serious trouble with insect pests. The irrigating facilities are so admirably arranged that no serious consequences can come from a summer drouth. It is only the lack of sufficient fall of snow in the mountains in the winter (the original supply of moisture) that can seriously affect the beet crop in Utah. This failure of snow-

fall in the mountains happened in the winter of 1899–1900, and the result was a poor crop of sugar beets the past year.

LEHI.—The Lehi Sugar Company established a factory of 350 tons at this place in 1891. It is the pioneer factory of the State, and has grown all its beets from the beginning through the aid of irrigation. Experience has shown that rainfall, when it can be had on the growing crop, is preferable. Irrigation is held off and simply used as a last resort when the supply of rain is not forthcoming. It has also been demonstrated that sugar beets can be very easily overirrigated. It has been one of the main difficulties to keep the farmers from giving their beets an oversupply of water. The experience of this enterprise can probably furnish more reliable information on growing sugar beets by irrigation than any other source in the country.

Through the establishment of its pipe lines for conveying juice from substations to the main factory, it occupies a unique position in sugar making in this country. It has two slicing stations, one at Springville, 22 miles south, the other at Bingham Junction, 19 miles north. These auxiliary stations simply extract the juice and transfer it to the factory through the pipe lines. The original working capacity of the main factory of 350 tons of beets per day was increased 350 tons by the establishment of each one of these auxiliary plants. This gives a total capacity of about 1,050 tons of beets per day at the present time. The resources for sugar making of this factory are most carefully studied and managed. During the campaign just closed it worked up 50,000 tons of beets and produced therefrom 5,700 tons of white granulated sugar. It had secured the planting of quite a large acreage, but, owing to the causes already mentioned, the tonnage was quite light, averaging only 8 tons per acre, as compared with 12¼ tons the year previous.

It is quite probable that the company will build another auxiliary plant. It aims to secure the planting of 8,000 acres in beets for 1901, and will pay 25 cents more per ton, based on the same rating for sugar and purity as last year.

A feature in which this company excels is the production of high-grade beet seed. Its production last year was about 40 tons. It began this enterprise several years ago. Its experience has clearly shown that high-grade seed can be produced in this country. Beets from such seed are grown under the same conditions as the beets which produced the seed, and better results are secured than from imported seed.

Along with the rest of the mountain region including the coast, Utah has experienced a heavy fall of snow and rain during the present winter (1900–1901). The main needs of the sugar-beet grower are already assured, and it is probable that this factory will perform the task of working up as much as 100,000 tons of beets next season.

Results at Lehi during the year 1900.

Date of commencing factory operations		27th of September
Date of closing same		10th of December
Number of acres of beets harvested		6,250
Quantity of beets worked	tons..	50,000
Average cost of beets per ton		$4.50
Average yield of beets per acre	tons..	8
Average sugar content of beets worked	per cent..	14
Average coefficient of purity		82
Amount of sugar produced	tons..	5,700

OGDEN.—The Ogden Sugar Company has established a factory at this place having a daily capacity of 350 tons. It completed its second campaign this last year (1900). It met the same adverse conditions as have been already described. It succeeded, however, in securing about 28,000 tons of beets, from which it produced about 2,900 tons of sugar.

The factory had planned to start up the last of September, but in this particular section tomatoes are extensively produced for canning purposes, and since this crop is much more perishable and requires more immediate attention, the farmers were inclined to get it out of the way first. The sugar factory succeeded in making its regular beginning about October 3. It closed its campaign December 11.

The farmers received this year a flat rate of $4.25 per ton for the beets. This would distribute about $119,000 in cash among the farmers of that section. The beets were a little better in their sugar content, but lower in their tonnage per acre than those grown for the factory last year.

It has been planned for some time to double the capacity of the factory. With the present outlook for producing a crop of beets, this will probably be accomplished before the campaign of 1901.

IN WASHINGTON.

WAVERLY.—The Washington State Sugar Company is operating a factory at this place of 350 tons daily capacity. Along with the rest of the mountain and coast region, this section has experienced an unprecedented drought during the past year. The average yield of beets is about 8 tons per acre. But, as has been shown in other localities similarly affected, the beets have a very high percentage of sugar, ranging over 17 per cent, with a purity coefficient averaging over 86.

The factory is anticipating much better conditions for next year and is making a strenuous effort to increase its supply of beets. Pledges were made by the Commercial Club of Spokane to furnish the product of 1,000 acres planted in that vicinity next year. The manager of the factory agreed to pay $4 per ton for beets yielding 12 per cent sugar and 25 cents extra for each additional per cent of sugar shown. He

agreed further to advance a certain amount of money during the spring to pay the expenses of producing the crop, deducting the same when the beets were harvested and delivered to the factory.

The factory produced during the campaign 1,132,500 pounds of sugar. It received in bounty from the State $11,325. Indications point to a more successful campaign for 1901.

IN WISCONSIN.

MENOMINEE FALLS.—The factory at Menominee Falls, which has been lying idle since its construction in 1897, has been bought up by a new company. It has a working capacity of 350 tons of beets daily. It will be operated next year by the Wisconsin Sugar Company. It is offering $4 per ton for beets and paying an additional amount on a rising scale, based on the sugar content, up to $5 for beets showing 16 per cent or over. The failure of this factory to operate in the past has had a depressing effect on the industry in Wisconsin. That State possesses many localities available for its introduction. This new turn taken by the factory at Menominee Falls will probably have much effect in reviving interest in sugar production in the State.

NEW FACTORY ENTERPRISES.

The year has been marked with activity on the part of local organizations and capitalists. Many new projects have materialized into actual organization and capitalization, followed by contracts for building factories for the campaign of 1901. Several other projects are on the eve of consummation, so that we can look to the coming year as one furnishing more new factories than any preceding year. This activity is not confined to any particular section, but appears generally in all parts of the sugar-beet growing territory.

Several things have united to make factory building a rather cautious and conservative process. Capitalists have waited to gather as full and complete information as possible relative to the ability of the industry to justify the claims made for it. They have waited anxiously for the development of the policy that shall prevail touching the importation of sugar from our insular possessions. A more intimate acquaintance with our own resources, along with a more settled conviction regarding the future career of the island sugars, has given factory building a more healthful status. We can consider that the era of factory building has been finally and permanently inaugurated.

In outlining the increase in available output of sugar for each year it must be remembered that this takes place not only through installing new factories, but through the extension of the capacity of those already established. There are but few factories in this country that have not doubled or trebled their capacity after the first year or two.

Those that have not done so are making every arrangement to do so. This doubling up as it occurs should be credited to the year's work in factory building. It adds as much to the increase of sugar production as if new factories had been installed representing a capacity equal to the increase. We shall have occasion to mention in this list of new enterprises this extension of capacity where known.

The following is a brief review of the new factory enterprises arranged in the order of the States in which they are located:

IN COLORADO.

As attention has already been called to the results attained in the Arkansas Valley, Colorado, where sugar beets were grown and new factories were in operation the past year at Rocky Ford and Sugar City, but little need be said in this connection.

The American Beet Sugar Company established a factory at Rocky Ford having a daily capacity of 1,000 tons. In order to secure a supply of beets the company controlled most of the land and leased it to the farmers at $4 per acre, the company furnishing the implements. About 4,000 acres were put under irrigation and cultivation. Irrigation appears to have prevented injurious attacks of insect pests.

The Denver News said at the close of the campaign with reference to this factory:

> The American Beet Sugar Company finished paying to-day for October beets. The sum of $152,000 has been paid to the farmers. Instances are numerous of profits of $100 per acre net and few are realizing less than $50. The American Beet Sugar Company is so well satisfied that the soil and climatic conditions in this valley are just right for the raising of beets of high percentage of sugar that arrangements are already about completed to double the capacity of the Rocky Ford factory.

This was the first year; the yield was high and the quality was good. This region presents a vast amount of territory available for growing the same kind of beets, and several projects are on hand to establish factories.

At Sugar City, in the same valley near Rocky Ford, another factory was started. Most of the beets covering 2,500 acres were planted on sod land, which was put to the test of growing a crop of sugar beets the first year. As an item showing the power of this industry in building up communities, the following is quoted from the Denver Republican:

> Sugar City is a new town in the Arkansas Valley which has grown up in consequence of the establishment of the beet-sugar industry in that vicinity. The National Sugar Beet Company is erecting a factory at that point and many farmers in the neighborhood have planted beet crops for the purpose of supplying the factory, which will be completed this fall (1900).
>
> Already Sugar City has a population of over 1,200 and mechanics have more than they can do erecting houses for the inhabitants, some of whom are living in tents. It is expected that there will be a large addition to the population before the end of

the summer, and everything shows that a prosperous community has been added to the number of Colorado towns. The results of the establishment of the beet-sugar industry in one part of the State is suggestive of what may be looked for when the production of sugar becomes one of Colorado's great sources of wealth.

The history of Sugar City will be repeated in large additions to existing communities, if not in the establishment of new centers of population. Grand Junction, where a sugar factory was erected last year, is enjoying greatly increased prosperity and the same is true of Rocky Ford, where another large factory is in course of construction.

In California the introduction of this industry in different parts of the State caused radical improvements in the communities thus favored, and valleys previously little better than deserts were made to support large populations.

Colorado is in both climate and soil so well adapted to the growth of sugar beets that no one can doubt that it will take a leading place among sugar-producing States. There is a sufficiently large market within and tributary to this State to support a dozen or more factories, each of which would exert a stimulating influence like that seen at Sugar City and in other localities where the industry has been started.

Here again experience with irrigation demonstrated that its application was a good means of destroying obnoxious insects that attack the beets.

For some years experiments have been carried on in the vicinity of Loveland, Colo., to test the availability of this section for producing sugar beets of good quality and quantity. Favorable conditions were shown so far as experiments could demonstrate the same. The Loveland Sugar Company was organized and offered $1,000 in prizes to sugar-beet growers for more effectually making these tests. The beets grown were to be delivered to the factory at Grand Junction. Prizes were distributed as follows:

For the person growing the most sugar on 5 acres: First prize, $125; second prize, $75; third prize, $50.

For the person growing the most sugar on 10 acres: First prize, $175; second prize, $125; third prize, $50.

For the person growing the most sugar on 15 acres: First prize, $200; second prize, $150; third prize, $50.

The results of these prize tests were so highly satisfactory that capitalists of Denver and Colorado Springs organized a company and contracted for a plant having a daily capacity of 1,000 tons. Contracts were secured with the farmers for growing the supply of beets and the factory will be in operation in the campaign of 1901.

IN INDIANA.

Last year a company was organized to establish a factory at North Judson. Contracts for several thousand acres of beets were made with the farmers. The beets were to be grown in 1900 for use in the campaign of the factory in the fall. For some reason this enterprise fell through, and arrangements were made to have the beets grown for the factory at Pekin, Ill., and some of the factories in Michigan. The question of building a factory was put over to 1901. This has

given the farmers some useful experience. I have been informed several times by the projectors of this enterprise that the factory will surely be built. It will be a factory of rather large capacity, and it will place Indiana in the list as a sugar-producing State.

Shelby, Ind., is also growing beets commercially upon quite an extensive scale for factories outside the State. This place has been worked up to the point of establishing a factory for some time. Stock has been subscribed to the amount of $500,000. Parties owning large tracts of land in this vicinity are interested. The factory will be built and in operation for the campaign of 1901.

IN IOWA.

In Iowa there are many projects under consideration for introducing the sugar industry into the State. There is scarcely a neighborhood in the northern half that has not been accurately tested through the efforts of the State agricultural experiment station and local organizations. It has been demonstrated that most of the places tested are available for growing a good quality and high tonnage of beets. The surety of a crop is an item in favor of this section. These experiments have been so numerous and so thorough that localities are practically resting on facts already ascertained, awaiting the action of capitalists looking for desirable places. Active effort has centered in a few places—Clear Lake, Iowa Falls, Storm Lake, Mason City, and Fort Dodge. These places all have active local organizations. Each of them grew from 150 to 200 acres of beets on 1 to 5 acre patches for the Minneapolis factory during 1900. I visited many of these fields just before the harvest and never saw better looking beet fields.

This was the first practical effort of these farmers, and the expense was higher than necessary. Had the beets been produced at an ordinary expense, the net profits of many of the fields would have purchased the ground the beets grew upon. The establishment of factories at several or all of these places may be looked for in the near future. Certainly no other places could present a stronger array of advantages when we consider the facilities for manufacture—cheap raw material, a large and assured crop every year, and an available market.

IN MICHIGAN.

Michigan seems destined to occupy the first place in sugar production. The present is her third year in experience in this work. She already has ten factories in operation and seems likely to start several more in the near future. This is one of the favorable indications of the progress of the industry. Results already obtained by the factories at work appeal to capitalists for continued investment.

The capital has been subscribed for building a factory at Salzburg,

a suburb of Bay City. The new feature about this concern is that it is cooperative to a considerable degree. About 1,000 farmers have invested in the stock and are to pay for the same in beets. The factory will be erected in 1901, and will have a daily capacity of 500 tons.

The Saginaw Sugar Company was organized at Saginaw with a capital of $300,000. The majority of the stockholders are from Saginaw. Some of the stock was taken in Cleveland, Bay City, Cheboygan, and Cairo. The contract has been let for building a $500,000 factory, having a daily capacity of 600 tons.

The Lansing Sugar Company was organized at Lansing with a capital of $300,000. Contracts have been secured from the farmers to produce the beets and the contract for building the factory has been let.

There is a strong probability of establishing factories at Dundee and St. Clair in the near future. It is claimed that the money has been partially raised for building factories at both of these places. Many other places are in indefinite stages of factory-locating development.

IN NORTH DAKOTA.

A sugar company has been organized at Fargo. A finance committee is proceeding with the work of raising capital and securing contracts with the farmers for growing the beets. Indications point to the success of the enterprise.

IN OREGON.

The citizens of Newberg, Oreg., have secured contracts with the farmers for growing 6,000 acres of beets on representation of capitalists that a factory will be built if contracts are secured. It is probable that a factory will be built here for the campaign of 1901. It is to cost $800,000 and will be located on the banks of the Willamette River.

IN UTAH.

The Utah Sugar Company, of Lehi, last year trebled its working capacity for the purpose of working up the juice from the two auxiliary plants established, one 22 miles south, at Springville, the other 19 miles north, at Bingham Junction. The factory is planning to put in another auxiliary plant about 14 miles south, using a pipe line already established.

These auxiliary plants simply extract the juice from the beets and transfer it to the main factory through pipe lines for further treatment.

A company was organized at Logan and a factory is now building with a daily capacity of 350 tons. Contracts with the farmers have been secured for growing 4,000 acres of beets.

The Utah Sugar Company, of Lehi, is planning to build a factory in Sanpete County, 125 miles south of Lehi, to be in readiness for the

campaign of 1902. The arrangements have been made, with every probability of materialization.

The Ogden Sugar Company has completed plans for doubling the capacity of its plant.

IN SOUTH DAKOTA.

At Aberdeen there has been much activity for some time in an attempt to secure a sugar factory. The local organization has several times had under consideration propositions from Eastern capitalists. Negotiations have been constantly directed toward the establishment of a factory. The following is clipped from the Oxnard Courier, of California:

> T. C. R. Crowell has offered to build a $600,000 beet-sugar factory at Aberdeen, S. Dak., if the citizens will subscribe for $200,000 of the stock, donate a site of 20 acres of land, exempt the property from taxation for twenty years, and guarantee that the farmers will produce 6,000 acres of beets a year. If erected, the factory will be a brick and stone affair, six stories high, and 175 by 400 feet. A committee of citizens has been appointed to take the matter in hand, see about securing a sufficient beet acreage, and also to attend to everything that will have to be arranged before the factory can be looked upon as a settled fact.

A company organized to build a factory at Oakes, N. Dak., has been incorporated under the State laws of New Jersey with a capital of $600,000. The contract has been let for building a plant with 1,000 tons daily capacity.

Several other places will probably mature plans for entering the field of sugar manufacturing in 1902. The two mentioned above will pave the way, and demonstrate what can be done in South Dakota in this direction. This will afford the other places abundant information for materializing their plans.

IN WISCONSIN.

Several years ago a factory was built at Menomonee Falls purporting to have a daily capacity of 350 tons. This effort was the one failure of factory building in the United States in recent years. The availability of its farming district had been thoroughly tested by the State agricultural experiment station at Madison. Contracts were made with the farmers to grow about 3,000 acres of beets. The factory was built, but was very late in its completion. The farmers grew a good supply of desirable beets. These beets were delivered to the factory. Owing to its not being completed, the beets were siloed in the ground surrounding the factory.

The factory had a very adverse career from the beginning. It started up, made a few pounds of sugar of poor quality, closed down, and passed into the hands of a receiver. There it has remained. It began the work of its campaign late in the winter. It was found that the

beets were rotting in the ground and deteroriating. This was given as one of the reasons for the failure of the factory. The loss to the farmers who grew the beets was almost a total one. Several efforts have been made to revive the enterprise, but none matured until the present one. Farmers hesitated to grow beets, remembering their past experience. This factory has been bought up by a new company, reorganized with new capital, and is being overhauled and put into shape for the campaign of 1901. The farmers demanded a security bond of $25,000 guaranteeing payment for their beets. These conditions have been met, and Wisconsin is to enter the list of active sugar producing States.

Indications are favorable for the establishment of factories at Green Bay and Canary.

IN OTHER STATES.

There are many places in other States besides those mentioned above where the subject of establishing factories has received very careful attention. In some cases factories are on the eve of materializing. Probably several communities will be able to establish factories in time for the campaign of 1901 or 1902. I have made every endeavor to get data regarding these proposed factories, but have not been able to get definite information. They are scattered throughout the sugar belt, east and west, some in New York, some in Indiana, Ohio, and Illinois. California has two or three well-matured plans, the details of which have not yet been given to the public, but they will probably result in the establishment of more factories in that State in the near future.

Insects and Diseases Affecting Sugar Beets.

There is no royal road to industrial accomplishments. The experience of the beet-sugar industry during the past year has been such that it is thoroughly alive to this axiom. The conditions of climate throughout the whole of the country has been, to say the least, peculiar. Most all of the regions record periods that were intensely hot, followed or preceded by heavy rainfall. The crops developed an abnormal tendency to disease and an unusual amount of attack by their insect enemies. The diseases that seemed most destructive came in the form of root blights, root rots, and leaf blight. There has seemed to prevail all the ordinary troubles that usually affect a crop of beets more or less, but the damage from these has not been extensive. In addition to this, there seems to have been at least three distinct diseases resulting in blight and rot, the symptoms and effects of which were different in the different localities. In places these diseases have produced quite serious results, in some instances destroying the entire crop, and in others resulting in greater or less injury to

the crop. These beet diseases were serious, both in California and Nebraska.

There has been a tendency on the part of the public to classify these diseases under the head of "root blight" or "root rot." Their seriousness has been such as to arouse considerable alarm among the factory people. Some have gone so far as to send agents to Europe to investigate the diseases affecting beets there, and the means used to eliminate the same. Considering it to be a matter of importance to accumulate as nearly as may be all available information regarding the diseases and insect enemies of sugar beets, I immediately entered into correspondence with the State experiment stations, calling their attention to the injuries to the beet crops. I asked that the botanists and entomologists secure specimens; visit the fields where practicable; study the different forms of disease and the insects prevalent; ascertain the manner of attack, the symptoms indicating the same, and the cause. I also insisted that the first prerequisite in entering into this contest with the enemies of the beet crop was an accurate outline of each disturbing element, defining plainly the symptoms and name with any treatment that might meet the situation.

In the pages following the results of the investigations made by these experts are given at some length in order that a beginning may be made in the compilation of authenticated data. These attacks are bound to recur from time to time. As the industry grows, these diseases may spread with it, and it is possible that we will have others with which we have not yet had any considerable experience.

There are insects and diseases affecting other crops which may find in this new one, when it becomes extensive and common throughout the country, a fertile field for attack. The beet may present the very condition necessary for stimulating their propagation, growth, and increase. The habits of life and modes of reproduction are known to the scientists. It is well to make the results of their investigations as available as possible in order that those interested may be equipped with a knowledge of the same and the best methods of combating them.

It will not do to become discouraged and relinquish our efforts because of these difficulties. In other lines of agricultural industry similar difficulties must be met, such as scale on the fruit crop; rust, smut, chinch bugs in the cereal crops; scab, rot, and nematodes in the root crops. These have been matters of careful study, and, through vigilance and right methods of prevention and extermination, we are able to bring our annual quota of these products to the markets.

The writer personally investigated the diseases affecting the beet crop in many sections of the country. The one that appeared most destructive came in the form of a root rot. This disease seems to affect the whole plant, and after it has developed for a time is transmitted to

surrounding beets, especially those in the same row. After a little experience it is very easy to detect the beets affected. The outside leaves turn black and die away; the leaves in the center of the crown have a dark green color, grow short and present a curly appearance. In the substance of the leaf between the veins appear raised places presenting a blistered appearance. A condition that is always shown in affected beets is the dark rings which appear outlining the fibro-vascular bundles. When the beet is cross-sectioned, these dark rings are quite pronounced, showing up quite plainly against the ashen color of the other tissues of the beet. If the beet is cut across, after a few minutes, these rings become much darker. In case of beets in which the disease has developed for some time, a black substance seems to exude from these rings and deposit itself upon the surface.

The sugar content of the beet runs down quite materially as the disease progresses. Finally, the beet becomes completely decayed, the rotting beginning with the tap root and progressing up the beet. There is a tendency for the leaves to become less in size and more curly in appearance as the rotting process continues. The leaves finally die; the top and the whole beet is consumed and stands a rotten mass in the ground. During the progress of the rotting quite an odor can be detected.

There seems to be another disease affecting the beets that is a modification of this one. The curled leaves are present, also the dark rings are found by cross section, but the rotting begins in the crown and goes down. The disease described above appears to be the one investigated by the experiment station at Purdue University, Indiana. This was the work of the botanists, Dr. J. C. Arthur and Miss Katherine E. Golden, the investigations covering the years 1891 and 1892 and being published in bulletin form.[1] A very exhaustive account of these investigations has recently been prepared by Clara A. Cunningham. The determinations of Dr. Arthur and Miss Golden, as outlined by Miss Cunningham, represented the disease as being of a germ origin.

I noticed another affection, which seems to be distinct from the one above. The leaves turn black and die down, leaving the root in a very withered, flexible condition. The root and the tissues of the same take on a dark-yellow cast, but there is not the tendency to rot.

There is another disease that appears to be quite prominent that affects the leaves, and, consequently, the growth of the beet. But my examination of this was too limited to justify an attempt to describe it.

The sum total of the damage done by diseases to beets throughout the country during 1900 was not one of vital moment. But it indicates that the beet-growing industry is not going to escape the diseases which have prevailed throughout Germany, France, and other countries.

[1] Bul. No. 39, Indiana State Expt. Station.

Among the practical questions to be determined in connection with bacterial diseases of beets are the following: Is it safe to plant a crop of beets the following year on land producing an infected crop? Will freezing destroy the germs? Will plowing aid? Should this land be planted in something else? What can be done by the farmer to rid the land of the infection? How long should sugar beets be kept off the land? These are questions of vital importance to the farmer which the experiment stations might investigate.

REPORTS OF SCIENTISTS.

In response to communications sent to scientific workers in several State experiment stations the following reports were received, which will be very interesting and helpful to sugar-beet growers and those interested in the sugar industry. These reports cover most of the diseases affecting sugar beets in this country, and especially those that were prevalent during the past season.

A BACTERIAL DISEASE OF THE SUGAR BEET.

I reproduce here part of an article bearing the above title, prepared by Clara A. Cunningham and read before the Society for the Promotion of Agricultural Science at the Boston meeting, August, 1898. The work of Miss Cunningham was the continuation and completion of an investigation and study made by Dr. J. C. Arthur and Katherine E. Golden, and published in the form of a bulletin by the State agricultural experiment station of Purdue University. This article by Miss Cunningham appears to cover completely the disease that was most virulent and least understood, and which appeared among the sugar beets in Nebraska and California the past season. The symptoms of the disease and the facts concerning its progress and development are very accurately described in this article, which was sent to me by Dr. Arthur himself in response to a letter of inquiry. I consider it a valuable compilation.

The letter of Dr. Arthur, together with the article of Miss Cunningham, follows:

PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION OF INDIANA,
Lafayette, Ind., January 8, 1901.

DEAR SIR: I have just returned from my holiday vacation, and find your letter of 21st ultimo awaiting me. What appears to pass under the name of root rot of beets does not seem to occur in this region, at least it has not so far attracted my attention. A disease which occurs each year to a limited extent has been discussed in the bulletins of this station as a bacterial disease. I send you herewith an account of it by Miss Cunningham, which needs no additional comment.

Yours, truly, J. C. ARTHUR.

In the autumn of 1890 Prof. H. A. Huston, chemist of the Indiana experiment station, noticed that the analysis of some sugar beets showed a much lower percentage of sugar than others, and the difference seemed to be associated with a slight

change from the usual appearance of the tissues of the root. This observation led to a microscopical examination of the affected beets by Dr. J. C. Arthur, who discovered the presence of bacteria in the tissues, to which, after further study, was attributed the abnormal condition of the beets. During the year 1891–92 the characteristics of the disease were studied by Dr. Arthur and Miss Katherine E. Golden, and the results published in the form of a bulletin in 1892.

This preliminary series of investigations determined that the disease was associated with a specific germ, which could be readily isolated from the diseased tissue.

No similar disease of the beet had been reported from any other locality in America at the time of the publication of this work. Dr. Ernest Kramer in 1891 reported a bacterial disease of the beet root attacking the fodder beets of Russia, and almost simultaneously Dr. Paul Sorauer, of Germany, reported a disease of the sugar beet of that country. In the Export of 1894, Dr. Sorauer gives his opinion that the disease of the fodder beet, named by Kramer *Bacteriosis gummosis*, and that of the sugar beet similarly named by himself *Bacteriose gummosis*, are identical, and perhaps very closely related to the bacterial disease of sugar cane known as "sereh."

The diseased beets, as observed in Russia, are described as having dried leaves with withered heart leaves. The roots of badly diseased beets were so tough they could scarcely be broken, the broken surfaces soon turning black. These beets produced a pathogenic effect on cattle to which they were fed. Many of the diseased beets when first sectioned appeared perfectly sound, but after a few minutes the fibrovascular bundles turned dark and a sirup-like gum exuded from the cells. In other beets the tissue was sometimes completely broken down.

Dr. Sorauer says: "The similarity between the beet and the sugar-cane disease, 'sereh,' consists in the destruction of the cane sugar and the increase of the invert sugar as well as the coloring of the vascular bundles and the entrance of bacteria." He also believes that the disease discovered in America by Arthur and Golden may be the same as that determined by Kramer and himself in Europe.

Mr. Walter Busse, in 1895, took up anew the study of the *Bacteriosis gummosis* of the sugar beet, the material for study being sent him by Dr. Sorauer. In describing the diseased root he speaks of the gum-like fluid as follows: "Soon after the drops appear on the surface of the sectioned beet they are covered by a thin black membrane, which consists of small, black, round bodies of different sizes."

The aim of Mr. Busse was first to determine the form of bacterium common to all the diseased beets by the separation of the germ from the diseased tissue, and second, to demonstrate that this was the specific cause of the disease by inoculating healthy beets with the germ. In the first series of experiments three germs were isolated. Two of these were discarded and the third form was kept for further observation. * * *

Mr. Busse is inclined to believe that the second form is a variety of the first, which he designates as *Bacillus betæ*. He has demonstrated that this second form produces the disease known as *Bacteriosis gummosis*, and believes that this germ is a saprophyte, which becomes a parasite in the tissues of the beet.

Erwin F. Smith, in speaking of the bacterial diseases of the sugar beet as reported from Europe and America, is of the opinion that the diseased condition of the beets studied by Arthur and Golden is due to some other cause than a bacterial one. He states that it is highly improbable that the root could be attacked by an organism which invades its tissues and yet does not break them down. Mention is made of the fact of the presence of small bodies in the tissue of healthy beet roots which have the appearance of bacteria, but which are probably crystalloid bodies. A paper by Dr. Smith was presented at the meeting of the Society for Plant Morphology and Physiology in December, 1897, calling attention to the existence in parts of the United States of a disease of the sugar beet resembling, if not identical with, that described by Kramer and Sorauer in 1891–92 and more recently by Busse.

In the fall of 1896 I had the opportunity to continue the investigation of the bacterial disease of the sugar beet observed in Indiana in 1890–91. Much of the value of my experimental study of this disease is due to the suggestions of Dr. Arthur, to whom I am indebted for kindly help and criticism of my work. I also desire to express my gratitude to Professor Burrage, Professor Huston, Miss Golden, and Mr. H. L. Bryan, also of Perdue University, for important suggestions. My investigations, which have been continued from 1896 to the present time, have resulted in no positive evidence that the sugar-beet disease of Indiana is the same as that described by Sorauer and Busse, of Europe. The points of similarity will be noted in the following description of the disease and of the germ by which it is produced:

About the middle of September, 1896, several diseased beets were found in the field of cultivated beets on the grounds of the Perdue experiment station. The disease attacks the whole beet plant, causing a peculiar appearance of the leaves, so that with a little practice the diseased beets can be distinguished readily from the healthy ones as they grow in the field. The outer, older leaves soon die away, and the intermediate and heart leaves are left wrinkled, curled, rather flabby than turgescent, and of a yellowish-green color. This wrinkled appearance is caused by blister-like patches being formed between the veins of the leaf, and the whole has been described as resembling a Savoy cabbage leaf.

The appearance of the exterior of a beet root when diseased is not materially different from that of the healthy beet. It is perhaps not quite as brittle. A decisive test for the disease is found in the appearance that the root shows when sectioned. The fibrovascular bundles appear as dark rings in the white flesh. They grow almost black after being exposed to the air for a few minutes. These rings are quite distinct from the cream-colored fibrovascular bundles of healthy beets.

In 1896, in a field of beets covering an area of about 1 acre and containing approximately 130,000 beets, 11 badly diseased and several slightly affected ones were found. This was a smaller number than had been found on the same ground in previous years, and can perhaps be accounted for by the climatic conditions being so favorable to plant growth the preceding summer, there being an abundance of rain. The number of diseased beets increased, however, toward harvest time.

Frost seems to be much more injurious to the diseased than to the healthy beets. The heart leaves of the diseased beets were more easily injured by the frost. It is characteristic of the disease that the leaves of badly diseased roots die away until no green leaves remain, leaving an apparently dead root in the soil, though its tissues will be found to be firm and not in the least broken down. The early frosts hasten the destruction of the leaves. Both diseased and healthy roots show an acid reaction, the diseased seeming slightly more acid than the healthy. * * *

It has been determined that a microscopical examination of the tissues of the diseased beets reveals the presence of bacteria in the cells of the plant. The tissues of the plant are not broken down, and the bacteria in all parts of the plant appear to be the same. Transfers of diseased tissue to the healthy beet root resulted in changed appearances of the plant which indicated almost certainly that the disease was transmitted.

The manner in which the germ finds entrance to the plant has not been determined. The conditions most favorable to the attack are those resulting from drought with succeeding low temperature.

The fact that the germ breaks down cellulose slowly explains the manner of its progress from one cell to another.

Experiments have shown that the germ in a medium containing a low percentage of acid grows nearly or quite as well as in one of alkaline nature, so that the acid element of the beet root does not offer material resistance to the germ.

The germ converts cane sugar into glucose in the process of producing gas. The amount of gas produced is not constant, but the reasons for this irregularity have not been determined.

The germ grows well with any form of sugar, and especially well in media containing cane sugar. This fact makes it seem probable that the germ is especially at home on those media which contain sugar in some form, although it will keep alive on media without sugar, and after cultivation for a time on such media will adapt itself to the conditions presented.

The colorless gelatinous form separated from the beet root in connection with the disease germ was at first thought to be an undescribed germ or rather the product of a germ, for only a few bacterial bodies could be detected under the microscope even when comparatively large masses of the substance were placed in the field. The organism appeared as small bacilli or micrococci.

The mass resembled the form of Leuconostoc so common in the vicinity of sugar refineries. Under the microscope, however, no streptococci were found, which characterizes Leuconostoc under the microscope. The gelatinous substance is soluble in water and alcohol; in the latter it turns to a milk-white substance before it dissolves. The substance increased rapidly in bulk when grown on sterilized beet. The mass did not dry out for months after the substratum had become dry and hard.

The substance grew well on 10 per cent cane sugar agar. The growth was slow at first, but after a week or two masses measuring a quarter of an inch in thickness and three-fourths of an inch in circumference, collected on the surface of the medium in stab and slant cultures. In case of stab cultures the agar was broken vertically along the line of inoculation. The colorless growth followed this break in the agar, and as the substratum became hard the mass collected as a colorless semifluid in the bottom of the test tube.

On slant agar there was a thin colorless layer, imparting a fluorescent hue to the medium. In agar plate cultures the organism formed small round colonies about the size of a pin head, resembling a small drop of water. These colonies were sometimes found with the disease germ, in plate cultures taken directly from the beet. It grew on sterilized potato, and to some extent on gelatin. Immediately after separation from the beet root the organism produced fermentation, but the power was lost after a time. Staining revealed only a structureless mass containing a few bacteria-like bodies.

Desiccation has little effect on the substance. Sections of beet on which the organism was growing have been kept in the laboratory until they are quite dried out, and the gelatinous mass is still apparent.

If this is indeed a form of Leuconostoc it is interesting to find it in diseased beet roots.

Work Done in the U. S. Department of Agriculture.

No exhaustive investigation of sugar-beet diseases has yet been made by the scientists of the Department of Agriculture. The following letters explain themselves:

U. S. Department of Agriculture,
Division of Vegetable Physiology and Pathology,
Washington, D. C., September 24, 1900.

Dear Sir: Your letter of September 15, addressed to the honorable Secretary of Agriculture, has been referred to this Division.

The beets sent in by Mr. H. S. Ferrar, of Grand Island, Nebr., have been received and examined. We have reported to Mr. Ferrar on the beets, and inclose a copy of our letter to him.

One of our men has been detailed to the study of beet diseases, and is already at work in California. There is no doubt that a number of diseases have become epi-

demic, and a thorough investigation of all of them is demanded. We trust that sufficient funds may be secured to carry out this matter.

Please let us hear from you whenever you come across anything which needs our attention.

Very truly, yours.

B. T. GALLOWAY,
Chief of Division.

Mr. CHAS. F. SAYLOR,
Special Agent, United States Department of Agriculture.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF VEGETABLE PHYSIOLOGY AND PATHOLOGY,
Washington, D. C., October 19, 1900.

SIR: I beg to acknowledge the receipt of copies of letters of Mr. C. F. Saylor, special agent in charge of sugar investigations, and to submit the following brief report on root blight in sugar beets.

At the present time there is no means of identifying the so-called root blight with any disease of the kind occurring in Europe, and the investigations which this Division has been conducting so far show that the root blight of Michigan, Nebraska, and Colorado is not the same in all cases. It is very likely that a number of diseases are confused under this one name, and a thorough investigation is necessary before anything definite can be reported. As indicated above, this Division has inaugurated an investigation of this disease, and it will be pushed as rapidly as possible.

There is no doubt that the epidemic nature of a number of beet diseases is due to the unfavorable weather conditions the past season.

Very respectfully,

B. T. GALLOWAY,
Chief of Division.

The SECRETARY OF AGRICULTURE.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF VEGETABLE PHYSIOLOGY AND PATHOLOGY,
Washington, D. C., September 24, 1900.

DEAR SIR: The beets forwarded to us at your request and Mr. Saylor's have been examined. We find that a fungus closely related to the root-rot fungus of cotton, cowpeas, etc., has attacked the lower part of the tap root and the fine feeding roots in all the specimens. It works in through the water-conducting bundles of the roots and finally up into the main beet root, causing a browning and drying out of the tissues and a blackening of the vascular bundles when, after the root is cut, it is exposed to the air. This blackening will occur at some distance beyond where the fungus is present. The indications are that the fungus is the prime cause of the trouble, though this could be determined only by careful field investigation and a long series of experiments testing the question of the parasitic nature of the organism, as it is accompanied by bacteria and yeasts in the tissues. Of course it may have been that the young feeding roots were killed by something else and the fungus followed as a secondary thing. The same blackening and browning of the vascular bundles is caused by the leaves being killed or seriously injured before the beet root is matured. This sometimes occurs as the result of an attack of leaf spot, produced either by the ordinary leaf-spot fungus (*Cercospora*) or the large leaf-spot fungus (*Phyllosticta*). Very serious injury has been caused by both these organisms in Michigan this season and the effect on the beet is much the same as the work of the root-rot fungus attacking the beets around Grand Island.

We are asking for an increased appropriation this year in order that we may make a thorough investigation of the beet diseases. The matter is of great importance, as some of the diseases have assumed epidemic character and bid fair to destroy the beet industry in several regions unless something can be done to check them.

Assuring you of our willingness to do anything within our power to help the beet growers and the sugar industry, I remain,

Very truly, yours,

B. T. Galloway,
Chief of Division.

Mr. H. S. Ferrar,
Manager American Beet Sugar Company, Grand Island, Nebr.

Work Done in New York.

Considerable attention has been devoted to the diseases of the sugar beet by the scientific workers of the experiment stations at Ithaca and Geneva, N. Y., as is shown in the following letter and articles:

Cornell University, Agricultural Experiment Station,
Ithaca, N. Y., January 8, 1901.

Dear Sir: In reply to your letter of December 28, sent to the entomologist of this experiment station, I may, as botanist, be able to tell you something of the root diseases of sugar beets most abundant in this State.

No bacterial diseases from this State have as yet come to my attention.

Beet root rot, caused by a species of *Rhizoctonia*, was abundant in 1898, and has since been found to a slight extent. A complete account of this disease will be found in Bulletin No. 163, Cornell Experiment Station, and inclosed I send you a briefer account of the gross characters, this printed account being part of a forthcoming bulletin (No. 186) of this station in cooperation with the Geneva Station (by B. M. Duggar and F. C. Stewart).

Beet scab, apparently identical with potato scab, is abundant.

Leaf scorch of beets sometimes leads to a discolored root, and so I include an abstract of F. C. Stewart's report upon this in Bulletin No. 162 of the Geneva Station, particularly as Mr. Stewart requests that I embrace his report in mine.

Very truly, yours,

B. M. Duggar, *Botanist.*

Mr. Charles F. Saylor,
Special Agent, United States Department of Agriculture.

Rhizoctonia on the beet (Beta vulgaris).[1]

Our attention was first called to this disease by specimens of affected beets sent to us from Binghamton. A few days afterwards the disease was discovered as a beet trouble of considerable importance at Cattatonk, N. Y. This occurrence has been fully treated in Bulletin 163 of the Cornell Experiment Station, and at this time a summary of these notes will suffice. At Cattatonk a 3-acre field was attacked so severely that fully one-third of the crop was lost. Diseased plants are usually found in scattered areas throughout the field; but the fungus undoubtedly passes readily from plant to plant in the row and it has a tendency to spread radially. Cold weather or dry conditions quickly retard the spread of the trouble, and it is much more abundant where the soil is moist or the surface drainage bad.

During hot weather the fungus secures a hold most readily at the bases of the leaves, perhaps because here there is moisture with the slighest rain or dew. Inoculation

[1] From Bul. 186, Cornell Agr. Exp. Sta., in cooperation with the N. Y. Agr. Exp. Sta., Geneva, by B. M. Duggar and F. C. Stewart.

experiments also demonstrate that in these parts the disease "takes" well. The progress of the injury may be noted by the blackening of the leaf bases, and finally the wilting and prostration of the leaves themselves. The leaves do not, however, turn brown until after they have fallen. When the fungus has worked into the crown and root proper, a browning of those parts is evident, and finally deep cracks may appear.

The brown mycelial threads of the fungus among the diseased leaf bases are evident to the unaided eye, and after the root has become affected a considerable mycelial weft may be found in the cracks and affected parts. A diseased beet sliced lengthwise and placed in a moist chamber yields in a day or two a luxuriant growth of the fungus.

This disease has since been reported to us in the central and the western parts of the State, but specimens are not seen. During the past season it was found again, in the month of August, at Flint and at Phelps, N. Y., but in neither case was there any serious outbreak of the disease. Specimens collected at the former place showed a considerable development of sclerotia, which bodies had not been previously observed upon the beet. Furthermore, Mr. A. D. Selby has kindly told us that he has found this disease of beets in Ohio during the past autumn.

Inoculation experiments have been made in the field, and these all indicate beyond a doubt that this *Rhizoctonia* may readily produce beet-root rot when the conditions are favorable. Moist conditions are essential for the spread of the disease from plant to plant. Moreover, this fungus taken directly from the diseased beets has the power of damping off lettuce and also beet seedlings.

A beet disease due to a species of *Rhizoctonia* has been known to botanists of Europe since 1855; and we are indebted to Prof. Karl von Tubeuf, of Berlin, for material of that fungus. It is improbable that the American form is identical with the European. However, the disease found by Pammel in Iowa may be the same as the one which we find in New York.

LEAF SCORCH OF SUGAR BEETS.[1]

This trouble was found in certain localities in August, 1899, and seemed to be caused undoubtedly by excessive transpiration during a season of hot winds, and other injurious conditions a few weeks earlier. Sometimes the trouble was manifest merely in the leaf margins. In severe cases, however, the leaf blades were killed, and only remnants of green petioles showed any living tissue in these parts. The root itself was sometimes affected, showing then a brown discoloration extending from the outside toward the center, sometimes to a depth of half an inch. There was no indication of true rot in this affected region. In some cases the fibrovascular bundles extending into the normal tissues were slightly blackened.

Results of Investigations Made in California.

Sugar-beet diseases have received some attention on the Pacific coast, but not so much as they deserve. Doubtless more thorough investigation will be made in the future. The following letter, dated December 26, 1900, was written by a bacteriologist of the State Experiment Station of Berkeley, Cal.:

Dear Sir: Your favor of December 21 regarding "root blight" of beets was duly received. Unfortunately, I have been unable to devote much time to the investigation of the beet troubles which have caused so much loss in California during the last two years. My observations have been limited to those made during two short

[1] Adapted from account by F. C. Stewart in Bulletin No. 162 of N. Y. Agr. Exp. Sta.

visits to the affected beet fields—one in 1899 and one in 1900. The conclusions I have come to are as follows:

The failure of the sugar-beet crop in Santa Clara, Santa Cruz, and Monterey counties during the seasons of 1899 and 1900 seems to have been due to three main causes. These are, in order of importance: (1) Drought, (2) "blight," and (3) root aphis. The failure in individual fields was due sometimes to one of these, sometimes to a combination, but was not all due, as popularly believed in the locality, to the new "blight" alone. This cooperation of disease causes makes the definition of the "blight" symptoms somewhat difficult. Several cases were distinguishable:

(1) Rich, loose, well-cultivated soil with abundant moisture; 75 per cent to 95 per cent of the beets missing; 5 per cent to 15 per cent very small; 5 to 10 per cent extraordinarily large and vigorous. In this case it appeared that the blight had attacked the beets when young and killed most of them. A few which were attacked with less virulence were not killed, but the roots were so injured that they were unable to grow large. Most of these had lost their central tap root. The remaining beets had apparently escaped infection and, having all the ground to themselves, had grown to immense size. In all fields exhibiting these characteristics the beets had been planted early.

(2) Similar to the last but only about 30 to 40 per cent missing; very few small and the remainder medium to large. In fields of this character there was often almost a full crop. They were invariably late planted.

(3) Soil not very well cultivated and deficient in moisture; 50 to 75 per cent of the beets missing; the remainder very small; crop a total failure. These fields were planted early.

(4) Similar to (3) but from 30 to 40 per cent of the beets medium to small. These fields were planted late and had from one-third to one-half a normal crop.

We have in these four cases, first: The effect of blight on early-planted fields; second, the effect of blight on late-planted fields; third, the effect of blight and drought on early-planted fields; and, fourth, the effect of blight and drought on late-planted fields.

There seems to be a critical period, due to the age of the beet, to the temperature or the moisture of the atmosphere, or to some unknown weather condition, during which the blight is particularly virulent, and those plants which escape infection at this period remain unaffected and make a normal growth. In 1900 this critical period seems to have been early in the season, as late-planted beets were much less affected. According to the accounts of growers, however, the late-planted beets were most affected in 1899.

Most of the symptoms of the "blight," such as darkening of the vascular rings, softening of the root, excessive growth of short rootlets, are common to other diseases. The only symptom that seems characteristic is a certain crumpling and turning in of the leaves caused by a pimple-like hypertrophy of the veins, and whether this is invariable or not I am unable to say as it seems to disappear as the beets become older.

I am still working on this beet trouble but have not the time or the opportunity to give it the attention it requires. It is of so much importance that I hope a suitable appropriation will be made this year which will enable some one to spend the necessary time in field investigation during the whole beet season, for this is the only way to get at the bottom of the matter.

Yours, very truly, FREDERIC T. BIOLETTI.

In Willett & Gray's Weekly Statistical Journal appears the following description from good authority of the sugar-beet troubles that have existed there:

On the affected plants the leaves curl by turning the backside of the leaf margins upward. The latter looks somewhat coarse; especially along the veins warty, small

elevations can be noticed. The tissue of the leaf seems to be thicker than that of a normal beet. All sick beets show an astonishing number of rootlets, while the normal beets have much less. In an advanced state of sickness, the leaves turn yellow and dry out. The root of the sick beet stops growing. The fertility and nature of the soil is not considered as the cause of this blight; neither is the variety of the beet seed, as the seed is equally distributed on all of the fields. It is concluded that the blight is caused by the dry hot air, the transpiration of the leaves is such an energetic one that the roots are not able to meet the demand for water; therefore the solution of nourishing matter in the leaves gets concentrated enough to hurt the tissue of the leaves, making them unfit to perform the duties of assimilating carbonic acid from the atmosphere to sugar and starch, etc. Furthermore, the water supply accessible to the rootless being exhausted the rootlets die; as soon as water has accumulated again a second growth of rootlets takes place, and so on (being something done very rapidly by beets, sometimes in the course of six hours.) The young beets are not so strongly affected as older ones, as they live on the nourishing stuff accumulated in the seed, but as soon as the surface of the leaves grows large enough in proportion to the rootlets, the effect of the too energetic evaporation of water becomes visible. A similar disease, but in a much more advanced state, was observed in Ontario and Yates counties, N. Y., on beets, cherries, cauliflower, and maple, and was reported in Bulletin No. 162, November, 1899, of the New York Experiment Station. The destruction of the leaves and even of the roots went much further than here, owing to circumstances very favorable to the disease. It is reported that after a sufficient rain the beets started a second growth, but showed a much lower percentage of sugar than normal beets grown in the same field. I believe the same will take place here. The reporter concludes:

Concerning treatment it is needless to say that proper irrigation is a sure preventive, but where irrigation can not be practiced, avoid planting on light, sandy soil, and in dry weather conserve the moisture by stirring the soil frequently, and especially after every shower.

Report by an Iowa Botanist.

Prof. L. H. Pammel, botanist of the Iowa Agricultural College, contributes the following general discussion of the sugar-beet diseases:

Brown root rot of sugar beets (*Rhizoctonia Betæ*).

In the year 1891 the writer became familiar with a root-rot disease that affected sugar beets quite seriously upon the college grounds in which this general statement was made. During the early part of August Professor Curtiss called my attention to the rotting of sugar beets in the ground. It was similar to certain root-rot diseases found on the beet in Europe. It did not appear to be the nematode disease common in Europe, though nematode worms were common in the decaying roots.

After a careful study of this disease the writer came to the conclusion that it is very different from the violet-root fungus so commonly affecting the sugar beets and other root crops in Europe. So far as I know the violet-root fungus has not been found in this country on the sugar beet or mangels, but it does appear upon the alfalfa in Nebraska; therefore, it may be looked upon as a possible source of danger to the sugar beet. The brown root-rot disease undoubtedly should be referred to the one described by a German scientist (Kuehn) and later recorded as quite destructive by Eidam in Germany, this disease affecting not only the large beets but young seedlings as well, sometimes destroying whole patches.

As to the appearance of this fungus in the United States I may say that since its recorded appearance in Iowa in the year 1891, Dr. B. M. Duggar, of the Cornell Uni-

versity Experiment Station, has recorded the fungus as common in New York. He says of the appearance in the vicinity of Binghamton:

Beet root rot was first brought to my attention as a disease of small extent in the vicinity of Binghamton. A few days afterwards it was found abundantly at Cattatonk, N. Y. A visit to the latter place on August 12 demonstrated that the disease was a matter of considerable practical importance. An examination of a 3-acre field on the premises of Philip Caple convinced me that probably one-third of the beets in this field were affected, and it was then too late to attempt any remedial measures with this root rot. Fortunately, some change in the conditions soon checked it, and my notes represent the final effect of the disease. A careful study of the affected field showed one point of peculiar interest. In certain areas the chipped tan bark of an old tannery had been thickly spread on the land, and in such areas there was not the slightest indication of diseased beets. The tannery product was quite dry, and I attributed the absence of the disease to the lessened water content of the upper layers of the soil, which assumption would be in accordance with the results of some experiments to be detailed later. Again, in a part of the field where coal ashes had been heavily applied, there was a noticeable diminution in the amount of the disease. This disease was afterwards reported from several places in the State, although it has not yet proved a common disease in New York. As mentioned later, what is probably the same disease was reported in Iowa in 1891, and it may have been observed in one or two sections of the country. It may be the same trouble that has several times been very destructive to the sugar-beet industry in Germany. Again, as subsequently noted, this beet rot is caused by the same fungus which causes a stem rot of carnations; and probably by the same fungus which produces some damping off diseases, so that we may predict that it has a wide distribution even at the present time.

Climatic conditions seem to cause a variation in the distribution of the fungus. Some years it seems to be particularly destructive. That was true during the years 1891 and 1892. Since then it has not been common. During the past season, when there was much complaint of root-rot diseases, the fungus was exceedingly rare. The writer found only a few specimens affected. How common it has been in the country this year the writer has been unable to learn.

In the year 1891 I carried on an extensive correspondence with several botanists of the country where experiments were being made with the sugar beet, but I was unable to definitely verify its appearance in any other State except Iowa. Diseased sugar beets were sent from Michigan, but these afterwards proved to be affected with an entirely different trouble. The disease is said, however, to have occurred in a few other places in this country.

I think there can be no question that the disease referred to by Professor Duggar is identical with that previously described by the writer. This disease manifests itself by gradual dying of the plant. Under favorable conditions this root rot seems to establish itself at the bases of the leaves. It is here where the infection apparently takes place, as Duggar has determined by experiment. There is a general tendency for the leaf to become black, then droop and fall to the ground, the leaves remaining green longer than is ordinarily true with other diseases. The chief injury by the fungus is where it works in the ground, where it causes the parts to turn black and ultimately to decay. As the fungus spreads, cracks appear on the surface of the side, until ultimately the whole root falls away. The disease spreads chiefly in the row, causing the so-called dead spots to form. Sometimes a dozen to fifteen plants in a single row and those on the adjoining rows will be affected.

On pulling an affected beet up the diseased part invariably has soil adhering to it, while the undiseased is free. The border line is marked by a brownish color. In very young specimens it is reddish, with the tissues more or less shrunken. A cross section through this part shows that the branched, nearly colorless threads ramify between the cells and intercellular spaces. Occasionally they penetrate the cell and occur in the cell cavity. An affected beet placed in a moist chamber is soon covered with a very dense growth of fungus. Every specimen examined contained this fungus, and frequently many other saprophytic species. Rotting beets give off a very strong odor not unlike that of rotting potatoes.

The technical name of this fungus is *Rhizoctonia betæ*, which is being worked out quite carefully by Stewart, of the New York Agricultural Experiment Station of Geneva, and Dr. B. M. Duggar, of the Cornell University Agricultural Experiment Station. They find the same fungus upon carnations and other plants.

BEET SCAB.

Another root trouble of sugar beets that has been destructive at times is the beet scab. The credit of having first discovered the relation existing between potato-scab fungus and beet scab is due to Prof. H. L. Bolley, of the North Dakota Agricultural Experiment Station. This writer, who had given considerable attention to the subject of potato scab, observed that when sugar beets followed potatoes they invariably produced a considerable amount of scab, and he soon demonstrated that a scab fungus could be established from this fungus beet that was in all respects identical with the fungus occurring upon potatoes.

Since then this fungus has been found widely distributed in the United States. The writer in the year 1891 called attention to its occurrence in Iowa, and since then he has repeatedly observed it on sugar beets. Thus during the past season it was observed on the college farm, and on sugar beets found in the vicinity of Fort Dodge and Webster City, and B. M. Duggar, of Cornell University, refers to its appearance on sugar beets in New York.

The chief characters of this disease are the warty excrescences that occur upon the beet. The scab appears very much like potato scab, being corky and somewhat spongy, the injury being not entirely superficial but ordinarily affecting the tissue immediately underlying. In its life history and development it is very similar to the potato scab, the scab being produced as a result of the development of cork due to the presence of the fungus.

BACTERIOSIS.

During September, when Mr. Charles F. Saylor was here, the beet patches were carefully gone over, and my attention was called to this peculiar disease, and then the writer and Mr. F. W. Faurot made cultures of the diseased beets. From these diseased cultures there were obtained organisms that in their morphology and biological characteristics, so far as they were carried out, answered to the description given by Arthur and Golden, and Cunningham, but the work was not carried sufficiently far, owing to a destructive fire in the laboratory, to determine whether it was pathogenic. However, I am inclined to think from the results of our work, so far as they have been carried out, that it may possibly prove to be the same thing found by these writers.

Mr. F. W. Faurot determined the loss and the percentage of the diseased beets in the field as follows: A count was made of several areas about 10 or 12 feet square with the following results:

Losses of beets from bacteriosis.

Area.	Total number of beets.	Number diseased.	Per cent diseased.
No. 1	50	20	40.0
No. 2	142	72	50.7
No. 3	78	38	48.7
No. 4	101	43	42.5
No. 5	91	59	64.8

The areas counted were selected at random, i. e., in various parts of the field, and no attention was paid as to whether they were in the least or the most affected part.

The spread of disease seemed to be general, i. e., about equally distributed in all parts of the field.

Dr. J. B. Weems, who has paid considerable attention to the chemical analysis of sugar beets, finds the following results of a number of analyses made at the station this year:

Results of analyses of beets, Iowa station, 1900.

No. of sample.	Data regarding beets analyzed.						Results of analyses.	
	When received.	Source.	Variety.	Condition.	Number of beets.	Average weight, trimmed.	Coefficient of purity.	Sugar in the beet.
						Ounces.		*Pr. cent.*
11	Oct. 16	Station plot		Diseased	7	17	65.55	5.97
12	do	do		Sound	8	22	78.87	9.44
13	Nov. 10			do	10	8	79.77	11.78
14		C. F. Saylor		Diseased	2	22	70.84	6.38
15	Nov. 10	Station plot	Zehringen	Sound	10	13	78.75	10 27
16	do	do	Cordes	do	10	16	78.61	10.48
17	do	do	White Vilmorin	do	10	14	72.28	9.28
18	do	do	Kleinwanzlebener.	do	10	11	73.89	10.26
19	do	do	do	do	10	15	70.94	9.26
20	do	do	Australian Special.	do	10	13	67.06	9.06
21	do	do	White Queen of the North.	do	10	12	57.08	9.23
22	do	do	White Imperial	do	10	14	71.39	9.66
23	do	do		do	15	20	67.86	9.53

The disease is readily recognized by the fact that the older leaves soon die and fall off. The heart leaves and those just outside of these have a wrinkled appearance and of a yellowish green color. This wrinkled appearance and the blister patches are well described and figured by Arthur and Golden,[1] and Cunningham.[2]

The beet has a normal appearance, but a cross section shows that there are dark rings. These occur in the fibrovascular bundles. When exposed to the air for a few minutes they turn almost black. A further description of this disease is given by Miss Cunningham, as follows:

Frost seems to be much more injurious to the diseased than to the healthy beets. The heart leaves of the diseased beets were more easily injured by the frost. It is characteristic of the disease that the leaves of badly diseased roots die away until no green leaves remain, leaving an apparently dead root in the soil, though its tissues will be found to be firm and not in the least broken down. The early frosts hasten the destruction of the leaves. Both diseased and healthy roots show an acid reaction, the diseased seeming slightly more acid than the healthy.

Some experiments were made by Mr. Faurot. Several germs were isolated from the diseased tissue, and one of these corresponded in its biological and structural characters to that isolated by Arthur and Golden, but the work was brought to a standstill by the fire which destroyed all of the cultures and notes. I am inclined to think that the disease is identical with that described by Arthur and Golden.

A bacterial disease of sugar beets has also been described in Europe by Busse, and Dr. Erwin F. Smith has called attention to a sugar-beet disease in America that resembles, if it is not identical with, that described by Kramer and Sorauer as well as Busse.

LEAF SCORCH.

Another disease that seems to affect the amount of sugar contained in the beet roots quite seriously is what is known as leaf scorch, which was described by F. C.

[1] Bulletin No 39: Purdue Univ. Agrl. Exp. Sta. [2] Bot. Gazette 28: 177.

Stewart[1] of the Geneva New York Agricultural Experiment Station in the year 1899. Here is the description of this disease given by Mr. Stewart:

On slightly affected plants the only indication of disease was to be seen in the brown or black dead-leaf margins. In more severe cases the young leaves at the center of the crown were black and dead, as were also the blades of most of the leaves. Many plants showed nothing green but the petioles of the larger leaves. In the petioles of the dead leaves the fibrovascular bundles were not blackened except, perhaps, for a short distance below the blackened blade. In the majority of cases the roots appeared normal, but the plants most severely attacked often showed a brown discoloration of the root. This discoloration extended from the outside toward the center for a distance of from one-fourth to one-half inch. The discolored tissue showed no indication of rot, and was separated from the healthy tissue by an indefinite and somewhat irregular line. The fibrovascular bundles colored somewhat more deeply than the parenchyma, giving a zonate appearance to the affected tissue. The location of the affected tissue could generally be determined before the root was cut open, by the darker color and pronounced elevation of the bark. In some cases when an affected root was cut crosswise just below the crown the fibrovascular bundles were found to be much blackened, but this character was by no means a constant one.

This disease is a physiological one. It is due to the fact that the plant gives off more water than it can take up.

Economic Entomology of the Sugar Beet.

Under the above title the Beet Sugar Gazette gives the following review of an Illinois experiment station bulletin:

A contribution of unusual value to the knowledge of the sugar beet and how to care for and protect it, especially in its infancy, from the numerous insects that continually threaten and often seriously damage it has been made under the above title by Prof. Stephen A. Forbes of the Agricultural Experiment Station of Illinois at Urbana. On account of its instructive character to beet growers and the general treatment of the subject, which brings it within the comprehension of the non-scientific reader, bringing its valuable lessons home to all, the important parts of this essay will be given wider publicity by the Beet Sugar Gazette.

New enterprises—new difficulties; new crops—new insect enemies and old enemies in a new rôle. The recent introduction and rapid extension of sugar-beet culture in America have brought to general notice several insect species not before known as injurious, and have given a new food to others well known for their attacks on the older crops.

The beet plant is very similar as food for insects to some of our commonest weeds, and hence it has attracted the prompt attention of several species which, if we have noticed them at all, we have hitherto regarded as our friends; and it has also served to give additional variety to the diet of several crop insects of somewhat general feeding habits. It has thus already recruited a large entomological following—about 150 species in America, if we put upon the list everything which has thus far been found to feed upon the beet in the field. Most of these, of course, can hardly be called injurious in the economic sense, but with our present knowledge of the subject, about 40 species may be definitely so classed. Furthermore, we may expect additions to this list from time to time, since the necessary concentration of beet culture in the neighborhood of factories and the consequent devotion of large areas to this crop year after year for an indefinite period give opportunity for an extraordinary multiplication and a continuous maintenance of its insect enemies. Doubtless, also, many beet insects, which, in the short period since beet culture began in America, have been present in small or moderate numbers only, will from time to time exhibit that tendency to extraordinary and alarming multiplication common among the injurious species generally.

[1]Ann. Rep. New York Agrl. Exp. Sta., 1899, p. 153.

It must not be inferred, however, that the beet plant is especially liable to insect injury. On the contrary, taking the country at large, it is at present less subject to such damage than corn or wheat, cabbage or potatoes. It is a fact particularly favorable to this crop that the marketable part of the plant is but little subject to injury by insects, by far the greater part of the species which feed on it infesting only the leaf, and relatively few injuring the root.

The critical period of insect injury to the beet is in the beginning of the season, while the plants are still small and slow of growth. There is at this time so little vegetation on the ground that a comparatively small number of insects may serve to lay the field completely bare; and poisons are often not available, since a leaf-feeding insect may completely devour the little beet while getting a fatal dose of poison for itself.

The principal injurious groups are the leaf-miners, the webworms, the cutworms, the woolly bears, and several other leaf-eating caterpillars, the wireworms, the white grubs, the flea-beetles, the blister beetles, the plant bugs, the leaf-hoppers, the plant-lice, and the grasshoppers. The webworms, the cutworms, the flea-beetles, the blister beetles, the leaf miners, and the root lice have done the greater part of the mischief in the States beyond the Mississippi; but in Illinois the only considerable injury seen by us in 1898 and 1899 was that done by the pale-striped flea-beetles, the grasshoppers, and the blister beetles.

Insect injuries to the underground part of the beet commonly take the form of a cutting of the taproot, an eating away of the smaller roots, or a burrowing or excavation of the mass of the beet itself. They are commonly due to wireworms, to white grubs, or to the beetles of one of the muckworms (*Ligyrus gibbosus*). More rarely root lice seriously damage the plant in summer by sucking the sap from the roots. It is probable that larvæ of some of the flea-beetles will also be found to infest the plant underground.

Injuries to the leaf may be done either by bugs with a sucking beak, or by beetles, grasshoppers, or insect larvæ, with biting mouths. The former abstract the sap from the stem or the blade of the leaf, often making discolored spots, dwarfing the growth and causing the leaf to curl, or even killing it completely. Beetles and their larvæ, caterpillars, grasshoppers and the like commonly make holes in the leaf, the smaller insects small circular holes, as a rule, and the larger ones either gnawing away the edge of the leaf, eating out irregular holes, or (if cutworms) cutting off the stalk near the ground. Small holes made in the young growing blade may greatly enlarge as the plant expands, becoming longest in the direction of the most rapid growth. Certain maggots of flies (the leaf miners) eat out the interior substance of the leaf in patches, leaving the cuticle unbroken.

The first injury to the beet reported in America was a mining of the leaves by the maggots of certain flies in a New York vegetable garden, an injury sufficient to prevent the use of the leaves for "greens." Later, serious and extensive damage was done by these leaf miners to fields of sugar beets in California. The leaf is penetrated by the insects, and the tissue is eaten out between the upper and lower layers of the cuticle, colorless, blister-like spots being thus produced.

Perhaps the most destructive of the beet insects in the West are the garden webworms (*Loxostege similalis* and *L. sticticalis*). The latter was in 1892 the chief depredator in the beet fields of Grand Island, Platte Center, and several other Nebraska localities, where many of the plants were entirely defoliated.

The garden Mamestra (*Mamestra trifolii*), a caterpillar allied to the zebra caterpillar of the cabbage, has been reported, by Prof. Lawrence Bruner, of Nebraska, to be quite common in that State and sometimes considerably injurious to the beet.

Cutworms have been noticed wherever beets are raised. Bruner reports them in 1891 as occasionally quite destructive to the plant while it is small, continuing their injury more or less throughout the summer. They commonly cut off the leaf at or

a little below the surface of the ground, but some of them merely feed upon the blades. In 1892 they almost entirely destroyed sugar beets growing upon two experiment-station plats at Lincoln, Nebr., on one of which only about 20 per cent of a stand was obtained. It was noticed here that little injury was done on land plowed the preceding fall and a second time in spring. Osborn noticed cutworms in Iowa doing serious injury to young beets in 1891.

The Beet Army Worm.

The State agricultural experiment station of Colorado published a bulletin on this subject, prepared by Prof. Clarence P. Gillette, the entomologist. On account of Professor Gillette's standing as an authority on entomological subjects, the article is reproduced here as being very pertinent matter for study by those interested in the growing of sugar beets.

LIFE HABITS.

The caterpiller which did so much injury to sugar beets in the vicinity of Grand Junction last year will doubtless appear again this summer. While the insect has long been known to entomologists, last year was the first that it has been reported doing serious harm to any crop.

While the life habits of the insect have never been studied, it seems probable, from what the writer could learn of it last summer and fall, that it has two broods in the course of a year. The caterpillars that were so abundant during August last year entered the ground and then appeared again as moths in September. There were few enemies to destroy the caterpillars, and the moths hatched in enormous numbers. These moths, like house flies and mosquitoes, seek every available place of protection from winter's storm and cold that they may live (hibernate) until spring. When vegetation starts, the moths, laden with eggs, go in search of beets or other plants furnishing suitable food, to deposit their eggs and thus provide for an early brood of worms. If 10 per cent of the fall brood of moths survive the winter, there is serious danger that beets will fare worse this summer than they did last, unless growers are early on their guard to make thorough and timely application of effectual remedies. Just here let me warn all against experimenting with new or patent remedies which some friend or vender may think entirely satisfactory. Use such remedies very cautiously and sparingly at first, or do not use them at all.

From what could be gathered last summer, it seems that there was a first brood of caterpillars at about the time for thinning the beets, which, in some cases, destroyed most of the plants after thinning.

REMEDIES.

Experiments tried last summer proved that the common poisons, paris green, London purple, and white arsenic, will destroy the caterpillars if well distributed upon the beets. These poisons may be applied dry or in water. If the caterpillars appear upon the beets while the latter are small, I believe the best method of application is to mix 1 part by weight of paris green or London purple with 20 parts of common flour, and then dust the mixture over the plants before sunrise in the morning. In this strength a light dusting will be sufficient. The early application is recommended because then the leaves have a slight amount of moisture upon them, which helps to hold the flour and poison. Just after the leaves are moistened by a shower is also a good time to make the application.

To apply the poison, make a small cheese-cloth sack about 5 inches in diameter and 10 inches deep; fill it with the mixture of poison and flour, and walk along a row of plants, shaking the sack over them. This can be done quite rapidly when

one has learned how, is economical of poison, and does not require wheelbarrow or wagon to carry pump and tank.

When the plants become large, as in case of treatment for the second brood, it will probably be better to use a barrel or tank and spray pump.

If a spray is used, apply either paris green or London purple in the proportion of a pound to 100 gallons of water, and add 2 pounds of fresh lime for each pound of poison. The lime should be slaked and strained through a sack to take out lumps; then use a nozzle that throws a fine spray, and do not continue the application in any place long enough so that the drops sprayed upon the leaves will run together and flow off, carrying the poison with them.

If white arsenic is used, prepare according to the following directions:

Put 2 pounds of white arsenic and 8 pounds of sal soda together in a dish and boil for twenty minutes in 2 gallons of water, and keep as a concentrated solution. It is extremely poisonous and should be placed at once where there is no possibility that children or domestic animals can get it. Also label it "poison" in large letters.

Then, in each 40 gallons of water, first slake 4 pounds of lime and then add slowly 1 quart of the concentrated solution while the whole is being stirred. The mixture is then ready for application, as in case of paris green. The lime should be strained through a cloth to take out the lumps.

I am advising the use of these poisons somewhat stronger than is common, but the experience of last year makes it seem advisable to do so.

Growers should keep the closest watch of their beets this year in order not to let the caterpillars get the start of them. I hope to be notified of any appearance of these worms or other injurious insects promptly, and shall be glad to do all in my power to aid those who are anxious to save their crops from the attacks of such pests.

EXPERIMENTS IN EXTERMINATING THE ARMY WORM.

In connection with what Professor Gillette has said above, I insert the following report made by him in the July number of the Beet Sugar Gazette, of Chicago, showing the success of his recommendations and what can be accomplished by vigilance and industry:

In the light of the trouble we had last year in this locality with the fall army worm, and which afterwards became known as the "sugar-beet worm," it may be of interest to you and to all sugar-beet raisers to know that we found a very simple remedy for it last year, and that we have no appearance of its return at this time. The remedy was in saturating the ground with water, killing the pupa, which enters the ground after each successive visitation of the worms, and there hatches out into the moth, which deposits the eggs for the next brood. It was discovered that on the fields where irrigation was in progress when the first brood made its appearance there was no second brood, and, following this up, we had the ground very thoroughly irrigated after the second brood, which seems to have entirely drowned out the pupæ, and this year there is no probability that we will be bothered with them.

As this pest was a serious matter with us last year, and as we learn it has made a visitation to other beet-raising districts, we felt that this news should be circulated as widely as possible, and in irrigated districts particularly it would be very easy to follow up our methods. In the rain districts we would expect the heavy rains to accomplish the same result.

We also found that the worms were very easily killed with paris green, as their work is entirely on the upper surface of the leaves during all the early stages, and only in the worst, or advanced, stages did they attempt to work at the base of the leaves or in the crown of the beet. One matter which facilitated the killing of these worms was the discovery that the beet plant was not easily injured by arsenical poisons, and that the strength which would be injurious to tree foliage and much other vegetation has no effect whatever upon the beet leaves. We used it in some

instances to the extent of 2 pounds to the barrel, with the addition of from 1 to 2 pounds of lime to each quarter pound of the arsenic or paris green, and the leaves seemed to be in just as good shape after its application. We found that half a pound to the barrel, thoroughly applied, was sufficient to kill the worm by simply spraying over the fields.

REPORTS OF MANAGERS OF FACTORIES.

At the time I sent out letters to experiment-station workers I also sent out letters to managers of factories, calling for specific data covering the experience of these factory districts during the season with diseases and insects affecting the beets.

It appears that the manufacturers had been early aroused to the importance of the situation, and, in their replies, were able to furnish some very valuable information, covering not only a description of the symptoms, but much scientific information bearing on the subject. They called to their aid the best scientific assistance they could secure to solve the problems before them. Much of the results is speculative, but throughout these reports are many important facts that will aid the sugar-beet grower in the future in classifying the beet enemies he has to contend with and applying remedies.

The reports of the managers of these factories follow:

Beet Root Blight in California.

Alameda Sugar Company,
San Francisco, Cal., October 3, 1900.

The following is submitted in reply to yours of September 24, 1900:

In 1899 the fields of the Union Sugar Company were badly affected by this disease, and much time and money were expended to determine the cause, and, if possible, the remedy. Our bacteriologist isolated the bacillus and determined it to be *Bacteriose gummosis*. The same disease was first noticed in 1890, and more particularly described by Sorauer, in 1893, and by A. Stift, of Vienna, in 1899. Of the agent in causing the disease there can be no doubt, but here our knowledge ends and speculation begins.

In Europe where the disease has caused as widespread injury as in the United States it has been attributed to drought, but from the writer's observation this can not be the cause in all cases, for in this State on the farms of the Spreckels Sugar Company this year, the land was well irrigated and yet the blight destroyed the entire crop. In Pajaro Valley the rainfall was about 30 inches, but disease has so affected the crop as to reduce it to about one-third.

This year the fields of the Union Sugar Company were not materially affected by bacteriosis, although it was present in isolated cases, and yet on unirrigated lands, although the drought has greatly diminished the yield, there was no spreading of the disease. On irrigated lands there were also isolated cases of bacteriosis, but they were insignificant.

On lands tributary to the Alameda Sugar Company there was no observation of the disease in 1899, but in 1900 the beet area was affected with it to a limited extent, say 2 per cent of the whole acreage, and this in but one or two fields.

Many have attributed the cause to bacteria occurring in the seed used, but the seed used by both the Alameda and Union Sugar companies in 1899 and 1900 was of the same importation as that sown for the Alameda Company in 1898, and the disease was not then noticed in this State. But to determine this question we had cultures made from the seed both from the surface and germ, and from all the varieties used without results.

Cultures were also made of the soil from samples taken to the depth of 2 feet, but although the cultures were prolific in life forms, none like *Bacteriose gummosis* could be isolated. These cultures can not, however, be regarded as conclusive for the reason that the samples were taken in the month of December, quite long after the beets were harvested and after rains had fallen. The depth to which the soil sample was taken may also have been of importance. From the fact that potatoes, tomatoes, squashes, and other vegetables have been materially injured by the same or a similar disease in various localities in California, it would seem that the bacteria might be in the soil notwithstanding.

Several test experiments were made on plots of land far removed from the beet fields, as follows:

1. Beet seed was sown in April, 1900, and after thinning, carefully examined at various times, bacteriologically, without result.

2. Young plants from disease-free fields were transplanted to this plot for observation. They remained free from disease.

3. Young beets from diseased fields were also transplanted and studied. Every care was given in the way of cultivation and moisture to see if the beets would recover. They did not recover.

4. Healthy beets from the previous year were inoculated from cultures of *Bacteriose gummosis*, but without success.

5. Healthy beets from this year's planting were inoculated with cultures of *Bacteriose gummosis* from affected beets from Los Alamos, Kings City, and Santa Maria, but the results were not definite. A fourth beet was inoculated with *Bacteriose fluorescens* without result.

A. Stift, of Vienna, previously mentioned, claims to have succeeded in inoculating healthy beets with the virus of this disease, but all attempts in this direction by our bacteriologist were unsatisfactory.

Comparative cultures from diseased beets of 1899 and 1900 showed that the bacteria of 1900 were less numerous and more attenuated than those from 1899.

Opinions have been expressed locally that the lack of moisture in the soil, at depths of 2 feet and more, has much to do with the unhealthy condition of the plant, and that when the soil is restored to its normal conditions by ample rainfall there will be no further trouble.

Certain it is that in one examination made by digging alongside a row of beets and following the roots down to their utmost limit, blight was found only in those beets which reached the dry subsoil, whereas those roots which had not yet penetrated the moist layer, showed no signs of blight. As this was an isolated case, perhaps no conclusions should be drawn from it, especially as in other localities roots still in moist soil showed the disease.

In general among those connected with the industry with whom the writter has conversed, the opinion prevails that thus far but little progress has been made in acquiring knowledge of the cause of the disease or in devising methods to combat it.

Yours, very truly,

ALAMEDA SUGAR COMPANY and
UNION SUGAR COMPANY,
By E. C. BURR, *Manager*.

AMERICAN BEET SUGAR COMPANY,
Chino, Cal., October 1, 1900.

We beg to acknowledge yours of the 24th ultimo, and in reply we beg to say that the root blight of which you speak has not appeared at this place. The blight which has affected our beets is not apparently in any way a rot, as the beets remain perfectly

sound. The leaves curl up and wilt, the growth of the beet is apparently arrested, and it throws out innumerable very small rootlets, sometimes almost entirely covering one side of the beet, so that, when it is taken from the ground, the body is very small, with a large mass of roots. We can not give any cause for the blight, as the various parties who have made investigations apparently do not agree. Some think it due to climatic conditions, some to a fungous growth, and others to bacteria. The blight usually does not develop until the beets have taken two or three months' growth.

Yours, truly,

AMERICAN BEET SUGAR COMPANY,
Per ANDERSON.

LOS ALAMITOS SUGAR COMPANY,
Los Alamitos, Cal., January 10, 1901.

There was very little rainfall for the season 1900, also for the two preceding seasons, so that there was very little moisture in the subsoil and for many feet below.

In regard to root blight it first appeared about the 1st of June. There had been no rain for nearly a month. On the driest light sandy soil the beet ceased growing, turned yellow; small leaves in the center of crown turned black and a gummy substance exuded. There was no rot; the beet began drying up though still showing signs of life; the fiber turned black, showing rings of blackness, and the beet was almost entirely covered with small fine roots. Beets on moist land were not affected. It was the fourth year of planting on this land, no beets having been harvested the two preceding years. The crop was badly damaged in sections of four different contiguous fields. Drought is the only cause I am able to suggest. There was only one disease here.

LOS ALAMITOS SUGAR COMPANY.

CALIFORNIA AND HAWAIIAN SUGAR REFINING COMPANY,
Crockett, Cal., February 28, 1901.

In response to yours of recent date, we send you reports from the managers of a number of our large beet farms.

(Signed) CALIFORNIA AND HAWAIIAN SUGAR REFINING CO.

Concord district, Contra Costa County.

Soil.—I am working all kinds of alluvial land, both light and dark sediment land, sediment and adobe mixed, alkali, and adobe. Practically all of this land has a heavy adobe subsoil, which is very cold.

Climate.—Our season's rainfall was about 15.75 inches, commencing in November, 1899, and stopping with light storms in March. Of this we had 11 inches previous to the 5th of January. Our season was therefore mostly free from spring rains, which we must depend on here to carry us through a long dry summer. During December and January we had six or seven weeks of foggy weather, during which we had numerous light rains, which kept the surface of our land wet, prevented plowing most of the time, and caused a rank growth of natural vegetation, which naturally dries out the land very fast.

Our winter was remarkably free from frost, with a good deal of damp weather; the ground was wet to a depth of from 4 to 5 feet. Most of our plowing was done after February 1, 1900, which was too late in the season for good results.

Results and observations.—On 100 acres of very heavy land, which I had plowed deep during June, 1898, for beet summer fallow, we had a good crop of beets, which

were in splendid shape, and were clean and free from rootlets, of good color and crisp; we had similar results on another field where the ground was lighter, being low and having a better supply of moisture, also having been worked early in the season, but plowed rather shallow. The above results were secured even where we had to plow under a heavy growth of grass late in the season, thus losing considerable moisture.

Aside from the above-mentioned fields, we had mostly a light crop of beets on all lands alike, most of the land having been plowed during late winter or early spring, and being new beet land it broke up cloddy. The season was such that the land did not slack, owing to the absence of frost and sun, and was only reduced to a seed bed by much harrowing, smoothing, etc., which packed the land too solid, though a good stand of thrifty beets was secured. They stopped growing entirely about the middle of June, when the hot weather came on, and the greater part of them burned later in the season. Examination at this time showed that the beets were covered from the crown down on the root with a network of fibrous rootlets. I think the trouble with our beet crop in this valley the present year was caused by lack of frost and sun during winter to slacken the clods and liberate the acid from the soil; and also, lack of moisture to sustain the beets when the warm weather came; thus the fungus attacked the beets and checked the growth.

The failure of our beet crop by what is known as "blight" is, I think, the result of a combination of conditions, namely: The acid in our soil causing the fungus in hot weather, which attacks the root of the beet; at the same time there was a shortage of moisture, and the beet plant was not in a vigorous condition to withstand attack.

I do not expect to see so-called blight next year.

Yours, respectfully, R. N. Burgess,
Manager Hookston Sugar-Beet Farm.

Report from K. G. Raaf, Sonoma County.

Replying to your inquiry in regard to beet diseases, I will say that at this location the soil is sedimentary, composed of sand, clay, and decayed vegetable matters, and has been reclaimed from the waters of the bay about ten years. Last year the land was plowed and planted to beets for the first time, with the exception of three small trial patches planted three years ago, which turned out beets fine in quantity and quality, and apparently free from all diseases. Last year something affected the beets which I never saw before, although I have been raising beets for the last nineteen years in almost all sorts of soils and climate. I am acquainted with the common diseases and insects that attack the beets, but have never seen anything like what appeared last season and what has been called "blight." It appeared only in patches here, and earlier beets were attacked more than the later planting; those planted in May were nearly free from the trouble, but I noticed that it was the opposite of other places.

I have some beets now growing that came up in the month of November which are from one-half to 1 inch in diameter, and they have a healthy appearance, the roots being free from the disease. It is my idea that something attacked the beet at the germination of the seed, because as soon as the two leaves were formed we noticed something wrong. After the plant formed four to six leaves they were of a light color, and on pulling up the root it was found that the small fibers lengthwise of the beet were dark in color; but the beet continued growing some until a fibrous, hairy growth appeared on the outside; then the plant seemed to stop growing, but neither decaying nor dying, as the climate here is favorable to growth.

The center leaves would drop off while new ones came on, the root getting hard and woody after two months. What the cause of this is I do not know, but as you ask for opinions I will state that I believe it is of a fungous origin, that conditions

probably were favorable for its growth, and that it is like the fungi that appear on other plants when conditions are favorable for the same.

Shall be pleased to find out something definite about this disease and what is the cause of its appearance. It was such a destructive agent among the beet growers of this State that no effort should be spared to find out what it is, and the proper remedy for the same. I saw land irrigated, land not irrigated, sandy loam, and adobe, but this disease seemed to get in its work everywhere.

Yours, truly,

K. G. Raaf.
In charge of Beet Farm at Reclamation.

Suisun district, Solano County.

In replying to your request for information regarding the sugar-beet crop, conditions of soil, etc., for the year 1900, I will say the season was very unsatisfactory in this locality, owing to the limited rainfall—which was only about 17 inches for the season, a greater part of which fell prior to February 16, and which was barely two-thirds the usual amount for this section—and also to the entire absence of the necessary spring rains.

The greater part of our land having never been plowed deep before, the proper seed bed could not be prepared in time, as we were unable to work the land until February. Our land is principally adobe, with the exception of about 200 acres of sandy sediment from which we harvested our best beets, this land being the best prepared and earliest planted.

We began seeding about the middle of February, finishing early in May, seeding in all about 1,000 acres. Owing to the late seeding and lack of moisture, there were several hundred acres upon which we failed to get a stand. We had a fair average stand on about 800 acres, which grew well until about the middle of July, when they began to dry in patches, the leaves shriveled, turned yellow, and the beet shrunk and died. In other places the leaves turned black and appeared as if they had been scorched by fire. They were very brittle and would crumble when touched, but the beet did not show any damage.

We began cultivating when the plants were about 3 inches high, and continued until they were too large for the cultivator to pass between the rows.

———.

Cordelia district, Solano County.

In replying to your questions as to conditions of beet crop for year 1900, I will state that the season was a most unsatisfactory one for beet farming, and under the conditions prevailing I am not at all surprised at the results. We had in all about 17 inches of rain, and, falling the way it did, this is a small amount for this locality, the two previous seasons being dry. Almost all of the rain fell before the middle of February, so we had no late spring rains, without which in this location the beet crop is almost sure to be a failure. The season was free from frosts, with continual fogs during the months of January and February. The weather, being warm, caused a great deal of vegetation to grow upon the land. The land, being a heavy soil mixed with more or less adobe and alkali streaks, is hard to work and prepare in proper shape for beets. Under the conditions prevailing, we were unable to commence plowing the land until the 15th of January, which is very late. The most of this land was never worked for beets before. The fogs prevailing at the time kept the land wet and moist, preventing harrowing and working otherwise.

Commenced planting on 20th of March, finished on 28th of April, having seeded about 750 acres. Had a good average stand on about 400 acres. The balance of seed planted failed to come up with exception of patches. We had about 1 inch of rain shortly after commencing to plant seed. The beets were well cultivated, and

on 400 acres looked well and thrifty until early in July, when they seemed to stop growing, and in patches seemed to be affected with blight. The leaves commenced to turn yellow and die. The weather all along up to this time had been cool. After a short warm spell it turned cool again. Then the beets already turned yellow began to look green once more and, I think, commenced to grow again. Later on I noticed something different, but only odd beets, some on high land, but I think a bigger percentage of those were on low alkali lands. Attention was drawn to these beets by their leaves being dead, and on pulling the beets they would be black and covered with a fungous growth, the dirt adhering to the beet. It is my judgment those beets were attacked by some insects. While thinning I noticed some plants affected in the same manner.

J. Smith,
Foreman Cordelia District, Solano County, Cal.

Report from New Hope district.

The disturbance appeared about the middle of June. At that time the weather was unusually hot, with almost continual high, hot north winds. Between the first and middle of June there were three very hot days. The first thing noticed was the leaves turning yellowish and curling up. Later on the outside leaves dried up and fell off. The center leaves started out again and looked to be healthy, but somewhat smaller. Some plants were affected more than others. Ones that were most affected did not grow after the leaves curled. The beets that were planted early were not affected so much as the late ones. The upper part of the beet root did not seem to be affected so much with the small fibrous roots as did the body of the beet.

There was plenty of moisture all this time, and when a beet was pulled the soil would adhere to the small fibrous roots in a large quantity and it was full of moisture. The early prospects were that from 10 to 15 tons per acre would be harvested, but owing to this blight only about 2 tons per acre were harvested on an average. Beets that were most affected with the small fibrous roots, when cut open, were of a darker color than those that were not. In my opinion the cause was too much early hot weather, with too much wind, which kept the dews from falling, and at the same time kept the tops of the beets continually moving night and day.

I noticed in the bottom of the sloughs that the beets were not near so much affected where they were protected from the wind.

D. L. Smith,
Foreman of Beet Ranch at New Hope, San Joaquin County, Cal.

Diseases of Sugar Beets in Colorado.

American Beet Sugar Company,
Rockyford, Colo., October 1, 1900.

We beg to acknowledge receipt of your favor of the 24th instant, and wish to say in reply that the root blight of sugar beets has appeared in the district of the Rockyford factory to such a small degree and so sporadically that no definite conclusion as to the cause of the disease can be drawn. The acreage for the Rockyford factory is spread over the territory from Pueblo, Colo., to Holly, Colo.

In explanation, we wish to say that affected beets are found on light and heavy soil; on land which has been irrigated three times, as well as on land which was not irrigated, and the diseased beets showed up in early as well as in late plantings. The disease developed only to such a small degree that the few blighted beets would never have been detected had not a very careful search been made for them after we received notice of the appearance of the disease in California.

During the last three weeks blighted beets have practically disappeared, so that

fields which showed a few diseased beets four or five weeks ago, at the time when the weather was very hot, are now, so to say, free from blight.

As to the point whether the land upon which a crop of beets has been blighted one year will transmit the same trouble to a succeeding crop of beets, we can not give data, as beets on a large scale for manufacturing purposes are grown this season for the first time in this locality.

Very truly, yours,

AMERICAN BEET SUGAR CO.,
Per WIETZER, *Manager.*

EXPÉRIENCE WITH BEET DISEASES IN ILLINOIS.

ILLINOIS SUGAR REFINING COMPANY,
Pekin, Ill., October 6, 1900.

Your letter of some days since to the Illinois Sugar Refining Company, relative to the root blight of beets, has been placed in my hands. In reply will say that in some of our fields, where the soil is strong, and especially where the dirt was thrown up into the crown of the beets, there has been some loss from rot; however, it has always appeared first at the crown of the beet and worked downward. In most of our fields there has been no loss whatever from this rot and in the fields most affected the damage would not exceed 6 or 8 per cent at the outside.

We have been troubled some, especially in localities where beets were grown last year, with leaf rust or blight. This appeared in places in our fields about September 1 and the leaves all died down in the spots or fields affected; however, most of the beets have sent out new leaves and the fields are as green as at any time during the growing season.

We will be only too glad to cooperate with you in any way possible and we take pleasure in sending you samples of the affected beets.

Very respectfully,

P. G. HOLDEN,
Superintendent Agricultural Department.

REPORT OF A MINNESOTA FACTORY.

MINNESOTA SUGAR COMPANY,
St. Louis Park, Minn., September 27, 1900.

Replying to your valued favor of September 24, we are pleased to state that as far as we have been able to ascertain, the root blight has not been noticed by our agriculturists and farmers in any of the territories where the sugar beets have been cultivated for us. In a few cases the leaf blight was noticed, but without any serious effect. The writer has found a solution of xanthoginate of sodium or potassium (the sulpho-carbon double salt), an effective remedy for the leaf blight.

Respectfully,

F. W. FINK, *General Manager.*

JANUARY 23, 1901.

Your esteemed favor of December 24 was forwarded to my present address, where I am staying for a while to attend to some business and private matters.

Inclosed please find answers to your list of interrogations, and also some remarks on last season, to which I refer.

In regard to diseases affecting the beet plant, which have been prevalent in other parts of the United States and in European countries, I am glad to state that our section has been spared, with the exception of some leaf blight in a mild degree, of which I spoke in a previous communication, and which occurred in a few fields only, without doing any damage to the crop. It was noticed only in a single instance that

a portion of 1 carload of beets out of about 25 carloads from the same farm (that of Thomas Lowry, Montgomery, Minn.) was affected by a fungous growth of a brown, woody, fibrous character. As nearly as I could ascertain, these diseased beets were the product of a small patch of which evidently the soil contained the origin of the fungus. All the rest of the beet field (about 25 acres) was not affected, but remained in a healthy condition.

Respectfully, F. W. Fink.

Views of Michigan Manufacturers.

Kalamazoo Beet Sugar Company,
Kalamazoo, Mich., January 15, 1901.

The secretary of our company (Kalamazoo Beet Sugar Company) forwarded me your letter of inquiry of Decemder 27, 1900. I will answer you to the best of my ability and knowledge.

The so-called "root blight," or "root rot" I would define as three distinct diseases, and possibly four, which are caused by conditions of soil and climate and the work of insects.

The first will be noticed in one or two weeks after plants come up; the bark of the root will turn black, and if unfavorable conditions continue it will rot the heart of the plant. It is caused by excessive wet and by ground becoming heated. It can in almost all cases be cured by thorough cultivation, airing the soil, unless wet weather continues. We lost about 4 per cent from this cause.

The next condition in this line appeared about July 1. We would notice a plant here and there decayed in the root and such a plant would soon die, and sometimes several around it would die; on examination I found small white worms in those roots, whether the affection was caused by the worms and whether it was contagious are questions I am not able to answer, nor am I able to prescribe any cure. We lost possibly one-half per cent from this cause.

About July 15 the leaf spot begun to appear on the leaves, small brown spots with darker margins and sometimes the edges of leaves would turn black and roll up dry. The disease would grow down from leaves to the root, making a fungous-rib growth around the crown of beet, with sometimes spots appearing lower down on the root. It would stop the growth of the root, and affected beets showed a low percentage of sugar. The only remedy I found that would do any good was the Bordeaux mixture. We lost probably 3 per cent from this cause.

The last half of July and first part of August we experienced wet weather in part of our territory, and, where drainage was poor, the ground was so heated and became so wet that it scalded the roots, retarding the growth and in extreme cases rotting the root. The leaf spot I think is caused by the conditions of the soil, partly drainage, and partly from ingredients of soil. Hoping you will find this information satisfactory,

I am, yours, truly, C. S. Bender,
Agriculturist for the Kalamazoo Beet Sugar Company.

Alma Sugar Company,
Alma, Mich., September 26, 1900.

Replying to yours of the 24th instant, I will say that we have not as yet had any experience with the root blight to which you refer; consequently we can not give you any information bearing on the subject.

Yours, respectfully, Alma Sugar Co.,
Per F. R. Hathaway,
General Manager.

HOLLAND SUGAR COMPANY,
Holland, Mich., September 26, 1900.

DEAR SIR: Referring to your favor of September 24, we will say that we have examined our beet fields somewhat during the latter part of the summer for this root blight and have found but little of it. A large percentage of our beets have been sown this year on low land, and we have had a very wet season, so that there is considerable rot on this lowest land, but it does not affect the beet in the same way as this root blight seems to, so we call it simply ordinary rot. What root blight we have found has been largely on the higher land, and especially on the light gravelly soil. We have had, however, a few cases on the lower land. Some places where it has started on the row it seems to follow right along, taking every beet. We have sent some samples to Washington for analysis, and will gladly furnish samples to our own experiment station at Lansing. The blight does not seem to be at all serious in this section.

Very respectfully,

HOLLAND SUGAR CO.,
C. M. MCLEAN, *Manager.*
Per S.

JANUARY 29, 1901.

Our beets this past season were damaged very little by any disease. There was only here and there a field in which we found anything that might come under the head of "beet blight," and no field was seriously injured. The traces we found in nearly every case were on high ground, usually in poor soil. Here in an advanced case the leaves would be entirely gone save for a dark mark on the ground where they had lain; the root would retain nearly or quite its full size, but would have left only what might be called the fibrous framework, dry, brownish in color, brittle, and, of course, entirely lifeless. In some instances the disease would appear to follow up the row from beet to beet, taking every root for several rods.

We regret that we can not give you more specific data.

Yours, very respectfully,

HOLLAND SUGAR CO.,
C. M. MCLEAN, *Manager.*

THE WOLVERINE SUGAR COMPANY,
Benton Harbor, Mich., September 26, 1900.

DEAR SIR: We have received yours of 24th, and in reply will say that we experienced a difficulty in our beet patches this year which corresponds in most important particulars to the ones you describe in your letter. In fact, it is so prevalent in our territory that it is hard to find any patches that are not more or less affected.

The principal difference between the trouble as it has appeared with us and your description seems to be that we do not find the roots affected by any apparent disease. The whole exhibition of abnormal appearance seems, so far as we are able to judge, to be in top or leaves.

I send you by this mail a number of the leaves as they appear at different stages during the progress of the difficulty. It appeared first about the last of July or first of August and on the patches that were growing on the lowest ground, and has gradually increased until, as I said before, there are very few of our patches that are not more or less affected.

We were at first inclined to think that it was caused by very heavy rains, followed by very hot sunshine before the patch had any time to dry off, and it is still undoubtedly true that the low patches that were subject to these conditions are the ones that were affected the worst.

The difficulty, however, varies from your description in the fact that there seems to be practically no rotting at the root. Beets that have been affected with this difficulty for two months, when pulled from the ground and the tops cut off are apparently as healthy and good-looking beets as we had last year. They are, however, abnormally low in polarization, showing a sugar percentage in the juice of between 11 and 12; the factor is apparently very high, showing in two series of tests within the last two days of 94 and 95 and 96 and 97, respectively.

When the difficulty has reached its ultimate conclusion, in such cases, where there has been no new growth of leaves, the beet when pulled up looks like one that has been allowed to lie two or three weeks and become very much dried up. There is in quite a number of the specimens which we have tested recently a large amount of invert sugar, amounting in some cases to nearly 4 per cent. We are unable to say that this difficulty has appeared with more frequency on fields where beets were grown last year, having appeared first on a field where there were no beets last year, but where the ground was very low, and where the conditions described before in this letter prevailed to a large extent. In another instance, where we have a piece of 154 acres, 100 of which was in beets last year, the disease appeared first, and just as badly on the new part, but extended at once and very rapidly to all parts of the field. This latter piece, upon which it is impossible to find a single beet which is not affected, does not show the slightest appearance of any abnormal condition of the root, but they only test about 9 per cent in the juice, and do not seem to have gained anything in sugar in the last three weeks. They have gained in appearance, the tops growing larger until at the present time each beet has probably 8 or 10 green leaves. These leaves are healthy, but are small. The crown of the beet during the progress of the difficulty becomes very much elongated until in some instances the crown will compose nearly one-half of the beet. We have supposed that this condition was caused by the continuous growth of new leaves.

You will of course notice the characteristic spotted appearance which shows itself on every one of the beets more or less affected.

In a general way, our opinion would be that the earlier planted pieces are affected the worst. This covers all that our observation has enabled us to learn. If there are any questions aside from this that you would like to ask, please do so without hesitation, as we should be very glad to act in conjunction with you, and also with the various experiment stations, just as far as we can.

Yours, very truly,

THE WOLVERINE SUGAR CO.,
H. C. ROCKWELL, *Secretary.*

TROUBLE IN NEBRASKA.

STANDARD BEET SUGAR COMPANY,
Ames, Nebr., September 26, 1900.

Your valued favor of the 24th instant is duly received.

We have had a good deal of trouble with root blight in our beet crop this season, it being our first experience with the disease, and there are naturally a good many different opinions among beet growers as to its cause, etc. The disease in our fields was first noticed during the latter part of July, our attention being attracted by the leaves of plants that were apparently healthy falling down flat on the ground, and the plant afterwards sending out little curly leaves. On pulling beets affected in this way and cutting them open it was found that there were dark rings all through the root, which seemed to be brittle and woody. A small percentage of beets was affected in this way at the time, but it seemed to gradually spread throughout the early part of August, and leaf spot also made its appearance in a great many of the fields at the same time. During the latter part of August a good many fields of early-planted

beets were quite badly affected with leaf spot, and at this time we had a period of extremely hot damp weather, and the foliage of the beets on fields affected as above described turned black and died, leaving the leaf stems standing. In most of the fields affected in this way a large percentage of the beets put out new and natural leaves, while a small percentage of the balance sent up the curly leaf, indicating the root rot, and the remainder developed the crown rot, the leaf stems turning black and rotting down to the beet, which in turn became affected. Our loss in tonnage from this cause, however, is not heavy—in fact, we hardly think our total loss of tonnage from root rot, leaf spot, etc., will be as high as 10 per cent.

Since the 1st of September we have had heavy and frequent rains, with cooler weather, and the crop has wonderfully recuperated. Plants that lost their foliage and were not affected with the root rot have grown new tops and are gradually coming up in sugar, while some that are affected have sent out side rootlets that are keeping the beet alive, though the point of the tap root has decayed, but the sugar content of such beets is in every case low.

The consensus of opinion here seems to be that the very hot damp weather, coming at a time when beets had been suffering for moisture, was largely responsible for the trouble. Since the weather has turned cooler it has stopped the spread of both leaf spot and root rot, which we consider two separate diseases. We have experimented largely with Bordeaux mixture to prevent the spread of leaf spot, but with very little apparent success, and we have concluded that rotation of crops is the best kind of a preventive, using lime as a fertilizer wherever practicable.

While leaf spot, according to the best authorities, can be transmitted to a crop of the same family, following a beet crop that is affected with it, yet we have concluded that it is largely caused by the climatic conditions, as we have had fields affected with it this year that were at least 50 miles from any point where sugar beets had been grown before.

We will be very glad to cooperate in every way we can with the State experiment station in any investigations they may wish to make.

Yours, very truly, STANDARD BEET SUGAR CO.,
Per H. SCILLEY.

JANUARY 9, 1901.

Referring to the matter of diseases of beets, I am satisfied that we had three distinct diseases here last season, which I would class as follows:

(1) Crown rot, which always exists to a limited extent, and with which we are all familiar. We can control this by pulling and burning or destroying any beets we find affected, thus preventing the spread of the disease.

(2) Leaf blight, called by botanists "Phyllosticta."

(3) Leaf spot, called by botanists "Cercospora."

The leaf blight and leaf spot first made their appearance in our fields during the latter part of July, after an extended dry hot period, followed by moderately heavy rains.

LEAF BLIGHT.

Our attention was first called to the "leaf blight" by the leaves wilting, falling flat on the ground and dying, the beet afterwards in some cases sending up little curly leaves, which we found indicated an unhealthy condition of the root. On cutting such beets open we found dark circular rings all through them; they were also brittle and contained much less juice than those that were not affected. In some cases the leaves came out in their natural shape again, but in growing the new leaves the crown became elongated, and in a great many cases hollow. In other instances the crown

rot developed, causing considerable loss, and almost every field affected failed to develop a satisfactory sugar content.

We believe that the disease developed on account of the growth of the beet being seriously checked by the dry hot weather before referred to, causing the beets to start to ripen prematurely; then when the moisture came they started a new growth. The weather at this time was extremely hot, and the disease developed in about three days. Its rapid development was doubtless materially aided by the physical condition of the soil, which owing to wet weather during the preparation of the seed bed was in a great many cases improperly pulverized and packed.

Another reason why we take the above position as to the cause of the disease is that late-planted beets that had not reached such an advanced stage of growth were not affected at all, though in a great many instances they were in the same field as those that were.

LEAF SPOT.

Leaf spot is a fungous disease often described in experiment station bulletins, and appeared in our fields as above stated, about the same time as the leaf blight. It started in some fields where beets had been grown the previous year and had been affected with the same disase. This first appeared in little brown spots on the leaves, which quickly spread, killing the leaves, and causing the beet to devote its whole efforts to the growth of new leaves. The fresh leaves in turn became affected, the result being long, hollow crowns, small roots and a poor sugar content. The disease after first making its appearance spread very rapidly, until the greater part of our acreage was more or less affected. We tried to prevent its spread by spraying with Bordeaux mixture, but without much apparent success.

It is pretty hard to estimate the damage to the crop, but in a rough way I should say that we suffered a loss of 15 per cent in tonnage and 3½ per cent in sugar content.

We attribute the cause of leaf spot largely to the fact that beets were planted a second time on the same land, the first crop having been affected with the leaf spot, and the germs or spores having lived over in the ground. We also think the climatic conditions were very favorable to its development. In some cases we thought it might be introduced in the seed, as it made its appearance in isolated districts where a beet crop had not been grown before.

Yours, very truly,

STANDARD BEET SUGAR CO.,
Per H. SCILLEY, *Agriculturist.*

AMERICAN BEET SUGAR COMPANY,
Grand Island, Nebr., January 12, 1901.

DEAR SIR: Your favors of September 24 and December 24 were duly received. In relation to the question as to root blight, will say that it appeared during the latter part of July and early in August, when the weather was very hot and dry. The leaves would wilt and in a few days entirely dry up. Sometimes the root would rot, followed by the leaves falling off. In other cases the root would dry up and get woody, with the dark circles running all through it. New leaves, curled inward, would put out from the crown but eventually die off. Very little of this sickness appeared in the late plantings. In all cases except where there was a good close stand it spread very fast. It destroyed about 20 per cent of our crop.

So many different opinions have been given by European professors and directors of agricultural experiment stations in this country that no specific decision as to cause has been arrived at. Beets grown from seed that had been treated with bluestone solution were affected the same as those from seed not so treated. I am of the opinion that climatic conditions, soil, and cultivation have a good deal to do with keeping it down. I would say that in this State where we had irrigated fields with

a regular supply of water, or where subirrigation was obtainable, there were very few roots affected thereby. In Anton Stifft's book, "Die Krankheiten der Zuckerrübe," Professor Sorauer is emphatic in stating that the best preventive in his opinion is thorough irrigation, and this we proved to be the case in Nebraska last year.

Very truly, HENRY S. FERRAR, *Manager.*

BLIGHT OF BEETS IN NEW YORK.

BINGHAMTON BEET SUGAR COMPANY,
Binghamton, N. Y., September 27, 1900.

DEAR SIR: Your letter to the Binghamton Beet Sugar Company was laid before me. I take pleasure in sending what information I can regarding the disease you write of. The following is an extract translated from Dr. R. Buerstenbinder's Zuckerrübe (sugar beet). He is a well-known German authority on the sugar beet. On page 235–236, edition of 1896, he says:

The beet rot is caused by a fungus called *Rhizoctonia violacea*. The diseased beets have a withered appearance, though at times the leaves are healthy while the roots are affected, also vice versa. When the leaves are affected, they die off and become a brownish-black color. When the root is affected, you will notice on the ends of the smaller roots smooth brown or violet spots, which gradually spread over the whole beet. As the spots spread the beet rots. The spots are called forth by the uniting of long twisted violet-colored fungous threads and the outside skin of the beet, some of the threads forcing themselves into the beet and causing the same to rot. This disease is especially found where the soil is damp and undrained or when stable manure has been used for spring fertilizing.

Very recently a peculiar disease has threatened the crop, which is called by Professor Kühn "cell rot." This disease seems to be like the potato sickness. The meat of the beet becomes spotted, black, and rotten. Fungous mycelium causes this, and destroys the cells of the beet.

In the last few years a kind of beet rot appeared in Germany called the dry rot. It was noticed that on the application of lime to the fields the fungus also appeared, but on the use of the lime cake it seemed to stay away. By using the lime cake a greater amount of lime was brought on the fields.

Very respectfully,

A. W. HOPPENSTEDT,
Head Chemist of the Binghamton Beet Sugar Company.

OCTOBER 3, 1900.

Your letter inquiring about a root blight on sugar beets received. This has not been at all serious with us as yet. My attention has been called to a few pieces where in spots there has been a rot or blight, but it has not been serious enough to affect the crop much. Two years ago, when we had a very dry July and a very wet August, we had some instances of rot, but these were not serious enough to do any great harm. The past season has been exceedingly dry, and I have heard of no instances of rot in any of the fields. We are just commencing to harvest, and from present indications the yield will be very satisfactory, considering the season.

We are in close touch with Cornell University, and they will do everything in their power to ferret out any trouble of this kind. I have visited several fields with their representative, and in some instances the Bordeaux mixture has been applied to see what effect it would have where the rot has made its appearance. I hope we may be spared any pest of this kind for some years to come. If we find any of it in our harvest would be glad to report to you any information we may be able to gather concerning it.

Very truly, yours, BINGHAMTON BEET SUGAR COMPANY.
J. E. ROGERS, *President.*

No Blight in Washington.

Washington State Sugar Company,
Waverly, Wash., January 5, 1901.

I have not yet completed the organization of this company, and can not give you as full information as you ask for. I do not know anything about the diseases that have affected the beet root in different parts of the country. We have had nothing like root blight, root rot, or anything of that sort. Last summer was exceedingly dry, and we noticed on the small roots on a few of the beets something like white mold, but it did not affect them to any considerable extent, and I think it was owing to the extreme drought.

If anything of the sort appears in the future, I shall be glad to give you all the information I can respecting same.

Yours, truly, D. C. Corbin.

Serious Damage in New Mexico.

The Pecos Valley Beet Sugar Company,
Carlsbad, N. Mex., October 8, 1900.

Replying to yours of the 24th, I send you herewith copy of a letter I recently wrote to Mr. R. M. Allen, of Nebraska, touching upon the subject mentioned in your letter. I also beg to advise that this year we planted a few acres in beets for experimental purposes, and part of it is affected with root rot, and also with leaf blight. I have sent a number of samples of our diseased beets to Newton B. Pierce, pathologist, Santa Ana, Cal., and have asked him to send me his report on the same.

I am not sure just what causes this root rot or blight in our country, because we find it on nearly every kind of soil we have here, and even where alfalfa has been plowed under, nor do I see any way to avoid it. We have treated the root rot by excessive irrigation, by very slight irrigation, by deep and shallow cultivation, but the rot seems to be about the same on all lands, no matter how treated. I can say this, however, that beets planted late, say in June, are not affected to any considerable extent, and not nearly so much as those planted early in the spring—in March, April, and early May.

Yours, very truly, A. S. Goetz, *General Manager.*

January 17, 1901.

As you are no doubt aware, we raised only about 12 acres of beets the past season, and these were grown for experimental purposes. Even on the 12 acres we had the same trouble that we had the previous years. We term the disease the black root rot, and not the "root blight," as so many seem inclined to call it. Our beets are put into the ground, germinate perfectly, and grow well until they are about two or three months old, then the black root rot affects them, commencing on the tips of the roots and gradually working around the beet until almost the entire beet is affected. The leaf growth dies down and almost wilts completely. In many cases the top portion of the beet lives and throws out new leaf growth in the fall of the year, and, while this top portion has a satisfactory percentage of sugar and a good purity, the rot so diminishes the tonnage that in many damaged fields it will not pay to harvest them. We have tried all methods of cultivation and irrigation without any effect, and are at a loss to state the absolute reason for this disease. It may be that our soil is lacking in nitrogen and is very strong in mineral substance. However, on all alfalfa lands and on lands that have been heavily manured by sheep, both of which put considerable nitrogen in the soil, we have had the same conditions. . . . We did not run this past season, so can not fill out your blank.

Yours, very truly,

Pecos Valley Beet Sugar Company.
Per Christian.

REPORT FROM AN OHIO FACTORY.

THE CONTINENTAL SUGAR COMPANY,
Fremont, Ohio, October 2, 1900.

Your inquiry regarding root blight at this point has been received, and at the same time I received a request on the same subject from the director of the experiment station at Wooster, Ohio. I inclose you herewith my observations on the trouble which we had here this season with leaf blight, but as far as the root trouble you speak of is concerned, we have had none of it here this season which has come under my observation. Occasionally we have found rotted beets, but no more so than is customary under ordinary circumstances, and there has been no distinctive or widespread disease of the character you mention.

My opinion is that every farmer should thoroughly and carefully spray his beets from two to four times in the season, and I think that by doing this he would save himself much trouble and loss from insects and diseases. My idea would be to spray the crop as soon as the leaves begin to appear with Bordeaux mixture and some arsenical poison. The strength, of course, would have to be regulated to the requirements of the young and tender plant. This preliminary spraying would, I think, be of assistance at that time, and I would then suggest spraying again soon after the beets were thinned and also twice during the month of July.

This matter of spraying need not excite the farmer nor cause him apprehension as to the matter of expense, as it can be very easily, rapidly, and cheaply done, and it is my belief that it would materially decrease injury from disease and insects.

Referring to the request for observations at this point touching sugar beets grown here and afflicted with what has been called the root blight, the writer would state that during the early part of the season, when the roots were still threadlike, there was prevalent in some fields a blackening of the outer covering of the root. The main artery of the beet retained a white silverlike appearance after the black outer part had been scraped off, and it was not long before the root shed this black outer skin and went vigorously ahead with its normal growth. I have noted this same condition in Colorado and Utah, and do not consider it at all serious, for, as far as my observations have extended, the beets always do well after the shedding of the outer skin.

As the season advanced here we noted about the latter part of July that in some cases an inch or two of the end of the taproot became very dark, tough, and woody. We found this condition to exist in a good many beets which we pulled out at that time, but since then we have seen nothing further of it, and out of over 1,000 samples which we have taken during the last thirty days we have not found one-half of 1 per cent affected in this way. As far as the so-called root blight which destroys the entire beet is concerned, we can say without hesitation that we have not been affected with it in this locality this season; but there appeared about the latter part of July and the early part of August, immediately following heavy rains succeeded by extremely hot moist days, a leaf disease which, for want of a better name, we have called leaf blight.

This disease first appeared as brown spots on the large and older leaves. Gradually after these spots had appeared other spots seemed to come on the outer edges of the same leaves, and the edges began to curl and turn brown, until finally the whole leaf in many cases became brown and dried, having the appearance of dried tobacco, and, on picking one of these leaves and rubbing it in the hand, it would crumble and break down into a dust very rapidly.

This trouble appeared in nearly every field to a greater or less extent. Where it was the worst, the outer leaves of the plant, which had been large and vigorous, disappeared entirely. In one case especially, where, from the luxuriant growth of the foliage, it had been almost impossible by a casual glance to distinguish the rows,

the appearance of the field changed within a period of two weeks so that no more foliage was apparent than could have been seen in the latter part of June. The disease did not appear to attack the younger leaves in the center. These seemed to continue their growth, new ones being put out from the center of the plant again, and by the latter part of September this same field had nearly recovered the appearance which it had before being attacked by the disease.

The disease appeared to run its course in from four to six weeks, beginning about the 20th to 25th of July and ending the latter part of August and first of September.

In a few exceptional cases the disease entirely destroyed the leaves, and, where this occured, rotting and decay of the beet set in, and total destruction of the root ensued, but the disease progressed from the crown downward and not from the taproot upward. Careful examination and experiments went to show that this disease of the leaves at the time caused a decided lowering in the sugar content and a large decrease in the purity, but since the 1st of September the increase in both sugar and purity has been very satisfactory; and to-day fields that were badly affected by this leaf blight seem to average as well in sugar and purity as those in which the disease only appeared to a very slight extent. An especially notable thing in regard to this leaf blight was that it attacked the older and coarser leaves, and left the young and tender leaves in the center of the beet practically untouched. Nor did it appear to attack, to any appreciable extent, very late-planted beets.

After the disease was discovered and it was noted that it was doing considerable harm, it was too late, and for other reasons it was impracticable, to make any thorough experiments with regard to a remedy. The Ohio State entomologist visited us, examined the fields carefully, and gave as his opinion at the time that it was a fungous growth which had made good progress under favorable weather conditions of much moisture followed by hot and sultry weather.

The writer has, within the last few days, seen in a German publication a colored plate showing this exact condition of the leaf, but has not had time as yet to translate the text and learn what they have to say regarding it.

Respectfully,

CONTINENTAL SUGAR CO.,
Per C. E. MITCHELL.

REPORT FROM AMERICAN BEET-SUGAR COMPANY.

OFFICE OF AMERICAN BEET-SUGAR COMPANY,
New York, N. Y., March 10, 1901.

At Grand Island, Nebr., the disease appeared the latter part of July and early in August. The tonnage of beets was reduced from 1 to 2 tons per acre.

The leaves would wilt and in a few days entirely dry up. Sometimes the root would rot, followed by the leaves falling off. Other times the root would dry up and get woody, with the dark circles running all through it. New leaves, curled inward, would put out from the crown, but eventually nearly all would die off. Very little of the sickness appeared in the late planting. In all cases, except where there was a good close stand, it spread very fast.

So many different opinions have been given by European professors and directors of agricultural stations in this country, that so far no specific decision as to the cause has been arrived at, so far as I know. Beets grown from seed that had been treated with bluestone solution were afected the same as seed not so treated. I am of the opinion that climatic conditions, soil, a good stand, and cultivation have a good deal to do with keeping it down. I would say that in this State, where we had irrigated fields with a regular supply of water, or where subirrigation was obtainable, there were very few affected roots. In Anton Stift's book, "Die Krankheiten der Zuckerrübe," Professor Sarauer is emphatic in stating that the best preventive, in his opinion, is through irrigation, and from personal experience I have proven this to be the case in Nebraska last season.

At Norfolk, Nebr., the disease appeared the latter part of July. The season had been dry, and when it did finally rain it was immediately followed by very hot weather. The previous winter had been dry, so the ground was not in good condition in the spring. It was first noticed by the leaves being affected. However, when beets were pulled the dark rings could also be seen in the root. Some of the beets were affected to such an extent that they rotted in the ground. All fields were affected more or less, and all beets in the field lost their leaves, part of them recovering to a certain extent.

A few fields were damaged to the extent of 50 to 60 per cent. In general our tonnage was reduced from 1 to 2 tons per acre.

In my opinion the trouble was caused by unfavorable soil and climatic conditions.

At our factory at Chino, Cal., the season of 1899 was very dry. The disease appeared about six weeks or two months after planting, and progressed rather fast on those affected. The beet stopped growing and sent forth many side roots or fibers; inside of the root was woody, and the cells turned black. On account of great drought it is impossible to tell what proportion of the loss was due to blight and what to climatic conditions.

At Oxnard, Cal., the disease appeared at an early age of the plant—shortly after thinning. The climate was generally dry. The beets were grown principally on land that had become strongly alkaline by evaporation, owing to lack of rain during the last three years. The leaves curled up, turned yellow, a gummy substance running from the stems owing to the breaking down or disintegration of the cell fiber. The root stopped growing, making only thick, heavy side roots. Upon cutting the root, the meat immediately turned black.

As the blight appeared only on strongly alkaline lands, the damage was hardly appreciable if the whole crop be considered.

The cause appeared to be unfavorable climatic and soil conditions. Where the soil was favorable and sufficient moisture available, no blight appeared.

At our factory at Rockyford, Colo., a so-called blight appeared sporadically, but it is doubtful if it was really blight. The damage suffered was very slight.

Respectfully yours,

JAMES G. HAMILTON,
Secretary American Beet Sugar Company.

REPORTS OF DIRECTORS OF STATE EXPERIMENT STATIONS.

In my annual reports I have always included the results of the experiments with sugar beets in the various States as reported by the directors of the experiment stations. This work is largely under the supervision of the directors, and I have felt that a report on the progress of the sugar industry would be incomplete without the results and observations of the experiment stations.

Up to the time of submitting this report several of the States that have been most active in prosecuting the investigation have failed to make response to my letter asking for these data. Those States not included in the list of reports are not represented for this reason. Letters have been received from some of them stating that data of results are being compiled and will be furnished as soon as completed, but inasmuch as this report must be published before the close of the fiscal year, June 30, 1901, reports from such States will have to be omitted unless received some time before that date.

The following are replies to letters of inquiry sent out by myself calling for this information:

ARIZONA.

Report of R. H. Forbes, M. S., Director and Chemist of Experiment Station, Tucson, Ariz., January 11, 1901.

Replying to yours of January 7, I am sending you our eleventh annual report, just issued, which contains a digest of our results with sugar beets for last year. These results are stated in two different places, pages 164 and 185.

In interpreting these results I will call your attention to Professor McClatchie's usage in relation to "available sugar per acre." He does not state total sugar per acre contained in the beets, but deducts from total sugar per acre, as found by multiplying tonnage into percentage of sugar in beets, the weight of soluble solids not sugar contained therein. On page 185, in order to introduce a means of comparison between my results and his, I have calculated "available sugar per acre" by his plan in the last column. According to your desire, therefore, you can use one statement or the other, based upon the data of the report.

Sugar beets were planted to a limited extent in Arizona last year, chiefly by the station, but also by a few farmers on the Upper Gila, who found them valuable as stock food. The season was exceedingly dry and the beets suffered in consequence.

There is no factory agitation here and no prospect of any factories being constructed.

The following statement prepared by Professor Forbes is taken from the report referred to above:

Climatic conditions having seemed favorable to beet culture on the Upper Gila, the station undertook to extend its work in this line to this district. In order that the experiment might be as conclusive as possible, Mr. C. G. Arney, trained to this work on the experimental farm, was put in charge of the plots. The ground and part of the labor was furnished by various public-spirited citizens of Safford, Thatcher, and Pima. Various types of soil were chosen, and plantings were made from February 23 until late summer. The seven main plots were of sufficient size to afford acreage tests from time to time, some of the results being stated below. The work suffered in several instances from the unusual scarcity of irrigating water this year, and the yields may be considered less than the average probability for this region.

Of these plots Nos. 3 and 8 were the only ones which did not suffer seriously for lack of water, and the total sugar per acre contained (2,267 and 3,361 pounds, respectively) is a fair result, taken in connection with the percentages of sugar (15.9 and 13.7) and the purities (84.5 and 83). Owing to the adversity of the season, it is thought that better results may be secured by a continuance of the work for the ensuing year.

Results on Upper Gila beet plots, planted February 28 to March 19, 1900.

Number, name, and location of plot.	Kind of soil.	Results, July 2–6, 1900.				Results, Aug. 3–13, 1900.				
		Sugar in beets.	Coefficient of purity.	Beets per acre.	Sugar per acre.[1]	Sugar in beets.	Coefficient of purity.	Beets per acre.	Sugar per acre.[1]	Available sugar per acre.[2]
		P. ct.		*Tons.*	*Lbs.*	*P. ct.*		*Tons.*	*Lbs.*	*Lbs.*
1. Morris, Layton	Sandy loam	9.9	75.2	5.9	1,174	10.4	72.4	7.3	1,521	940
2. Brinkerhoff, Thatcher.	Adobe	12.0	82.5	4.86	1,169	13.6	81.6	7.38	2,006	1,554
3. Hubbard, Pima	Heavy adobe	12.2	81.8	4.43	1,077	15.9	84.5	7.13	2,267	1,852
4. Hoopes, Thatcher	Sandy	13.8	79.5	3.34	924	.....	.....	.....	.....	.....
5. Zundle, Thatcher	do	14.8	84.6	2.9	859	13.0	85.4	5.74	1,491	1,237
7. Mrs. Layton, Thatcher.	do	10.55	80.2	4.7	989	12.3	79.5	.....	.....	.....
8. Marshall, Pima	Silty loam	11.0	78.1	8.6	1,892	13.7	83.0	12.3	3,361	2,679

[1] The "sugar per acre" in the above table is total sugar per acre contained in the beets.

[2] "Available sugar per acre" is approximately that which can be recovered in the process of manufacture.

Report by A. J. McClatchie, Agriculturist of the Station, from annual report of the station for 1900.

Experiments were conducted with sugar beets this year, mainly for the purpose of testing methods of irrigation, other points in their culture having been pretty well settled by previous experiments. A sowing was made September 12 in a gravelly loam, and irrigated at once, as is necessary at this time of year. The winter being quite mild a fair growth was made. Samples taken April 2 gave the following results: Average weight of beets dug, 12 ounces; yield per acre, 11.5 tons; sugar in beets, 14.7 per cent; purity coefficient, 83.3. These are probably as good results as could ordinarily be expected from seed sown on the earliest practicable autumn date.

At the close of the year 1899 bulletin 31 was issued giving the result of the year's work. The averages from ten plats sown during January and February, 1899, were as follows: Yield per acre, 9.75 tons; per cent sugar in beets, 15; purity coefficient, 77.7; available sugar per acre, 2,010 pounds. The most important of the conclusions from the work of the year was that winter-sown beets are not benefited, and may be injured, by early irrigation, provided the soil has been thoroughly irrigated previous to seeding. The indications were that the most advantageous time to begin irrigating is when the beets are two to three months old.

A plat sown December 26 and first irrigated April 1 gave the following results:

	Sugar in beets.	Purity coefficient.
June 15	15.0	88.1
July 1	16.4	88.4
July 11	16.4	86.0
July 30	16.9	84.4

The yield upon the latter date was 14.5 tons per acre, giving an approximate yield of available sugar per acre of 4,050 pounds, the highest yield yet obtained from any of the experimental plats during the past four years. This yield of sugar per acre evidently remained about constant during all of June and July, the increase in the percentage of sugar being just about counterbalanced by a decrease in the purity coefficient. Only a tenth of an inch of rain fell upon the plat from the time of seeding until the first irrigation, over three months later, during which period they made an excellent growth. This result was accomplished by a thorough irrigation of the soil previous to seeding.

COLORADO.

Report by L. G. Carpenter, Director of State Experiment Station, Fort Collins, Colo., January 11, 1901.

In answer to your inquiry of January 7, regarding sugar beets in Colorado during the past year, a general statement regarding the conditions of the State during the past season and the progress of the sugar-beet industry will probably answer your needs.

Three beet-sugar factories have been in operation during the past season: One at Grand Junction, which began operations the year before; one at Rockyford, and one at Sugar City—the last two being in the Arkansas Valley. The last two have had a most excellent run this season. The yield of beets has been good and the sugar content high. The exact acreage I am unable to give, but it has been in the neighborhood of 9,000 acres for these last two factories. The month of April in the Arkansas Valley was abnormally wet, there being a rainfall of over 7 inches as compared with the previous average of 0.89 inches. During May and June the rainfall was very nearly the normal, and during the subsequent months it was below the average. This gave good conditions for ripening and favored a large content of sugar. The average sugar content at Rockyford was nearly 17 per cent, some beets running as high as 26 per cent of sugar. The price was based on a sliding scale, so that these beets brought $7.67 per ton.

As the sugar industry seems to have been put on a commercial basis the station has done less during the past year than previously in experimental work, and has

grown very few on the station grounds this year, though it has grown some by cooperation in the State.

The town of Loveland is likely to have a factory put up this season. Contracts for beets have been made and the company is prepared to erect the factory. Denver is agitating the construction of one, and two or three more are planned in the Arkansas Valley. Our bulletins 42 and 51 give facts regarding tonnage and sugar content for two years' trials in the State

CALIFORNIA.

Report by E. W. Hilgard, Director of State Experiment Station, Berkeley, Cal., January 10, 1901.

In reply to yours of January 7, regarding the conditions of sugar-beet culture in this State, and our experiments, I would state:

The crop conditions in this State during the past year have been very unfavorable to the sugar beet, on account of the exhaustion of the moisture in the lower layers of the soil mass; and in consequence of this the quantity was small, although the quality was high. The extent to which the beet was planted during the past year was less than usual, because of the discouraging results of the preceding years. The lands naturally moist have been generally planted, while the higher lands have been left out.

The only places in which the establishment of sugar factories have been mentioned in the past year have been Sacramento and Stockton, but no definite action has been taken. Quite lately the subject has been broached in the Perris Valley, in Riverside County. No factories will be built during the coming year. The factories already in existence are somewhat anxious in regard to obtaining a proper supply of beets to keep them running. They are inclined to put in beets on their own land and on their own account, in order not to be subjected to the results of the discouragement which the neighboring farmers are laboring under.

Our object in our work with sugar beets during the season of 1900 was to test some special seeds sent us from Europe, but the results were wholly abnormal and are not worth mentioning. We will probably make similar experiments at our substation during the coming season, but do not think it necessary to test the production of beets in various localities of the State any further, as the ground has been well covered by experiments made under the initiative of the factories.

Our experiments indicate an average production of from 10 to 12 tons per acre in good land; as much as 18 tons has repeatedly been grown. The sugar content when the beets have been properly handled has always been high, as is indicated by the fact that the factories have placed their normal figure at 15 per cent. In California the purity is, as a rule, higher than elsewhere, ranging between 85 and 91. As to the cost of production and net profit the several factories can give the best information.

The last three years have been so abnormal in reference to agricultural production in California at large that the discouragement in regard to beet-sugar production is not likely to exert any permanent influence upon its pursuit in this State. In the past no such succession of dry seasons has occurred as far as records reach, and the natural presumption is that it will not again occur soon enough to influence the present generation in the pursuit of the beet-sugar industry.

IDAHO.

Report by S. Avery, Chemist of State Experiment Station, Moscow, Idaho, January 14, 1901.

In accordance with your request of the 12th instant, I take pleasure in handing you herewith a report of the work in sugar-beet culture for the past year.

The crop conditions were unfavorable in those parts of Idaho which depend on rainfall. July and August were hot and dry.

The Department distributed about 300 pounds of seed, without any restriction as to locality. Two franks for mailing samples were sent to each grower in the fall, but comparatively few samples were received for analysis.

So far as I know, Payette, in Canyon County, is the only point agitating the establishing of a factory.

The experimental work of the station during 1900 was to determine if a profitable yield (with a satisfactory sugar content and purity) could be obtained, so that we could advise farmers to grow beets for the factory at Waverly, Wash. The field work was under the charge of the agriculturist, Professor French. The crop was almost a failure.

The experiments on the campus were under the direction of the horticulturist, Professor Huntley. Certain plats were on ground that had received a heavy coating of manure three years ago; part were in a soil almost devoid of humus. In the latter case the results were similar to those of the field experiment. The plats which had previously been manured gave a very satisfactory yield. The complete data has not been compiled, but will be given later in a station bulletin.

My experience in beet culture in Idaho is confined to the past season, but from a careful study of the records of this station, from comparing conditions with those of other sections, and from a comparison of notes with the horticulturist and agriculturist, I offer the following opinions on the possibilities of beet culture in Idaho: (1) Beets of high sugar content and purity can be raised in all the agricultural sections; (2) in the parts of the State depending on rainfall, there will be difficulty in securing a satisfactory yield except in abnormally wet seasons, especially during July; (3) the higher irrigated portions of the State may have to contend with an occasional abnormally cold season; (4) I see no reason why the lower irrigated parts, such as Washington, Canyon, and Ada counties, should not be most admirably adapted to the culture of the sugar beet, and I trust that the extensive experiment planned for Payette and vicinity may be successful in all respects.

A number of farmers raised beets in Idaho under contract with the Waverly sugar factory. Mr. Paul Leuschel, Moscow, Idaho, had charge of the contracts. He can doubtless furnish exact figures. Those farmers that I have talked with report that they received pay for beets of about 16 per cent sugar and for 3 to 4 tons per acre.

The results of experiments during the season, except yield per acre, are given in the following table:

Results of sugar-beet experiments in Idaho, 1900.

No. of experiment.	Variety.	Weight of beets.	Sugar in beet.	Sugar in juice.	Purity coefficient.	Name of grower.	Location.	Remarks.
		Oz.	*P. ct.*	*P. ct.*				
100	Klein[a]	14.6	15.5	16.3	84.0	W. A. Zumhof	Moscow	Average.
101	.....	29.0	15.6	16.4	82.8	H. R. Russell	do	
102	Klein	18.9	16.9	17.8	83.2	J. M. Thompson	Rich	
103	.....	16.3	16.8	17.7	83.5	J. G. Jarron	Moscow	
104	.....	18.0	15.8	16.7	84.4	George Davis	Wilford	
105*a*	Vilm.[b]	13.3	17.3	18.2	89.6	W. A. Zumhof	Moscow	
105*b*	do	16.3	16.3	17.2	87.7	do	do	Grown on high ground.
105*c*	Klein	26.2	15.9	16.8	85.2	do	do	Largest in crop.
106	do	20.4	15.9	16.8	87.9	H. T. Coats	.....	
107	do	10.9	18.7	19.7	86.7	D. J. Waite	Teakean	
108	do	25.7	15.6	16.4	85.8	R. D. James	Russell	
109*a*	.....	25.0	15.2	16.0	83.3	N. M. Hawley	Moscow	One red beet in sample.
109*b*	.....	25.2	13.3	14.0	79.5	do	do	
110	.....	26.5	17.9	17.9	86.9	D. Jarrett	do	
111	.....	5.7	16.3	17.2	88.6	P. C. Olesen	do	
112	.....	11.6	18.1	19.1	88.4	O. O. Hurt	do	Average.
113	.....	60.4	14.1	14.9	80.9	do	do	Very large.
114	.....	20.5	16.9	17.8	89.0	J. H. Tyler	do	

[a] Kleinwanzlebener. [b] Vilmorin.

Results of sugar-beet experiments in Idaho, 1900—Continued.

No. of experiment.	Variety.	Weight of beets.	Sugar in beet.	Sugar in juice.	Purity coefficient.	Name of grower.	Location.	Remarks.
		Oz.	*P. ct.*	*P. ct.*				
115	Klein...	63.5	13.7	14.5	81.9	Station	Moscow	Large beet; fertilized plat.
116	....do...	16.2	18.1	19.1	91.3	.....do	.....do	Perfect beets; fertilized plat.
117	....do...	15.9	15.8	16.7	85.2	.....do	.....do	
118	....do...	5.7	16.8	17.7	87.6	.....do	.....do	
119	....do...	10.2	14.3	15.1	83.4	Miss A. Bowman	.....do	
120	Vilm ...	19.7	14.1	14.9	75.9	Station	Plat 38	Medium-sized.
121	....do...	20.3	14.2	15.0	82.4	.....do	.....do	Do.
122	....do...	5.5	15.3	16.1	84.7	.....do	.....do	Very small.
123	....do...	45.4	12.3	13.0	75.1	.....do	.....do	Largest in sample.
124	Klein...	19.6	13.6	14.3	80.7	.....do	Plat 37	Medium-sized
125	....do...	12.9	16.6	17.5	86.2	.....do	.....do	Do.
126	....do...	73.2	13.9	14.7	80.8	.....do	.....do	Largest in sample.
127	....do...	8.8	17.4	18.3	91.0	.....do	.....do	Small.
128	....do...	31.1	14.3	15.1	83.9	.....do	.....do	
129	Vilm ...	32.3	15.5	16.3	86.7	.....do	Plat 6	Large.
130	....do...	4.5	15.7	16.6	87.4	.....do	.....do	Small.
131	....do...	16.4	16.1	17.0	88.5	.....do	.....do	Medium-sized.
132	Klein...	14.7	15.5	16.4	85.4	.....do	Plat 1	Largest in sample.
133	....do...	14.4	16.8	17.7	92.1	.....do	.....do	Medium-sized.
134	....do...	3.6	17.2	18.1	88.7	.....do	.....do	Small.
135	Vilm ...	34.8	13.9	14.7	82.6	.....do	Plat 38	Large.
136	....do...	11.7	14.9	15.7	84.8	.....do	.....do	
137	....do...	40.9	15.2	16.1	82.9	.....do	.....do	
138	Klein...	33.5	16.1	17.1	89.0	.....do	Plat 37	
139	....do...	25.4	16.5	17.4	87.8	.....do	.....do	
140	.....	19.9	14.7	15.5	81.5	C. J. Edwin	Moscow	
141	.....	7.6	21.3	22.5	85.2	J. M. Garrison	Nezperce	Somewhat desiccated.

MARYLAND.

Report by H. J. Patterson, Director State Experiment Station, College Park, Md., January 14, 1901.

In answer to your circular letter of 2d instant, would say that all the information which we have in reference to sugar beets and results with experiments as far as compiled are given in Bulletin No. 61 of this station, a copy of which we send you by this mail.

There is but little interest at this time among our farmers as to sugar beets; in fact, it has been pretty well shown that there are no large areas in our State adapted to the growing of sugar beets, especially not enough to make it desirable to put up a factory.

MINNESOTA.

Report by W. M. Hays, Agriculturist of State Experiment Station, St. Anthony Park, Minn., January 29, 1901.

Your letter of January 4 to the director of this station is in my hand for answer, as our director has gone to California to spend the winter.

The crop conditions of the season of 1900 were very peculiar. It was exceedingly dry during May and June, and wet during the remainder of the year. I believe the factory at St. Louis Park had about the same acreage to draw upon as last year, 2,000 acres.

I do not know of any active organization trying to establish a factory in Minnesota at present. As you know, New Ulm, Albert Lea, Winona, and other points have "had their latchstring out." I presume no new factory will be built in 1901.

In variety tests at the station the results were as follows: Tonnage per acre, 15 tons; cost of production, $33 per acre; sugar content, 14 per cent; coefficient of purity, 83.

MISSOURI.

Report by H. J. Waters, Director of State Experiment Station, Columbia, Mo., January 11, 1901.

Replying to your circular of the 2d, will say that the results of all of the tests made by the experiment station and the United States Department of Agriculture, extending over a number of seasons and embracing all sections of the State, indicate that Missouri is not well adapted to the production of sugar beets containing a high content of sugar and with a high degree of purity. Consequently the experiment station has made no experiments along this line during the past two years, and has no new data on this subject. There is no agitation in this State in regard to the building of factories or the establishment of this industry.

MONTANA.

Report by F. W. Traphagen, Special Agent in Charge of Beet-sugar Investigations, State Experiment Station, Bozeman, Mont., January 18, 1901.

Director Fortier has handed your letter to me for reply.

The conditions for the production of sugar beets, as judged by the product, were not favorable last season. Because the seed was received too late, there was little planting done in the State last year.

A sample from Sunnyside Stock Farm, Cascade County, grown on alkali land, showed the following results on analysis: Average weight, 5 ounces; Brix degrees, 22.5; sugar in juice, 15.5 per cent; sugar in beet, 14.72 per cent; purity coefficient, 70.

Analysis of beets grown at the experiment station yielded the following results: Average weight, 6½ ounces; Brix degrees, 18; sugar in juice, 14.2 per cent; sugar in beet, 13.5 per cent; purity coefficient, 79; yield per acre, 8¼ tons.

Billings, Bozeman, and Miles City are agitating in a somewhat passive way the establishment of factories. No factory is in sight in the near future. The beets at the station were from the rotation plats and were used in experimental pig feeding with other food with highly satisfactory results.

The results of this past season, taken as a whole, are among the poorest of the several years of our experiment.

Speaking of the results of experiments covering several years past, I feel safe in saying that the tonnage can be conservatively placed at 15 to 20 tons per acre, and the cost of production at about $20 per acre. A sugar content of 14 per cent and 80 purity can be maintained. Additional information concerning previous results is to be found in our annual reports.

NEW MEXICO.

Report by Arthur Goss, Vice-Director of Experiment Stations, Mesilla Park, N. Mex., January 29, 1901.

Your favor of January 5, to the director of this station, has been referred to me. In reply to your questions I will say that crop conditions in New Mexico last season were unusually dry. The only beets grown in the Territory during the season of 1900, so far as I know, were in connection with the sugar factory at Carlsbad, and with the experimental work at the station here.

Factories have been mentioned in connection with a number of places in the Territory, notably Santa Fe, the Animas Valley, and Roswell, but I am unable to say what places will build factories in 1901–2.

The purpose of the experiments with sugar beets at the New Mexico station and substations during 1900 was to continue the tests of varieties in different parts of the Territory, as has been done for several years past. The work at the central and substations, as well as the cooperative work by farmers in different parts of the Territory, has demonstrated that remarkably high-grade beets can be grown in the Territory, especially in the northern portion. This fact will become more apparent by referring to the following table in which are given the average results, so far as secured, from Santa Fe and San Juan counties since 1897:

Results of analyses of beets grown since 1897 in Santa Fe and San Juan counties, N. Mex.

Year.	Santa Fe County.				San Juan County.			
	Number of samples.	Weight of beets.	Sugar in beet.	Purity coefficient.	Number of samples.	Weight of beets.	Sugar in beet.	Purity coefficient.
		Pounds.	*Per cent.*			*Pounds.*	*Per cent.*	
1897	24	1.66	14.33	79.6	14	2.00	15.64	81.3
1898	10	1.10	17.76	82.1	10	1.20	16.77	88.4
1899	4	.70	18.15	82.5	8	1.47	17.25	81.2
1900					6	1.32	19.43	87.1

In the following table are given in detail the results secured last season at the central station at Mesilla Park, Donna Ana County, and at the substations at Las Vegas, San Miguel County, and at Aztec, San Juan County. These beets were grown, sampled, and shipped strictly in accordance with instructions and, consequently, represent what can be secured under favorable conditions. Special care was taken to guard against evaporation during shipment, and to analyze as soon as possible after digging. The beets were all received in practically perfect condition, very little loss of moisture having occurred:

Results of analyses of sugar beets grown at the New Mexico Experiment Station, and the Las Vegas and Aztec substations, 1900.

CENTRAL STATION, MESILLA PARK.

Variety and source of seed.	Seed furnished by—	Planted.	Harvested.	Average weight.	Sugar in juice.	Sugar in beet.	Purity coefficient.
				Pounds.	*Per ct.*	*Per ct.*	
Vilmorin, France	U. S. D. A., No. 3941	Apr. 7	Nov. 14	1.16	10.0	9.5	62.9
Strandes, Germany	U. S. D. A., No. 3942	do	do	1.07	12.5	11.9	67.2
Dippe, Germany	U. S. D. A., No. 3944	do	do	1.01	14.2	13.5	68.3
Mrozinski No. 1, Russia	U. S. D. A., No. 3943	do	do	.94	11.3	10.7	70.0
Mrozinski No. 2, Russia	U. S. D. A., No. 4416	do	do	1.14	14.3	13.6	74.1
Licht Improved	F. O. Boyd, New York	do	do	1.25	12.4	11.8	72.1
Average		do	do	1.10	12.45	11.83	69.1

LAS VEGAS SUBSTATION.

Strandes, Germany	U. S. D. A., No. 3942	May 5	Dec. 1	1.31	14.2	13.5	82.6
Dippe, Germany	U. S. D. A., No. 3944	do	do	1.08	15.8	15.0	81.9
Mrozinski No. 1, Russia	U. S. D. A., No. 3943	do	do	1.18	15.9	15.1	84.6
Mrozinski No. 2, Russia	U. S. D. A., No. 4416	do	do	.80	20.0	19.0	90.0
Licht Improved	F. O. Boyd, New York	do	do	1.30	16.3	15.5	83.6
Average		do	do	1.13	16.44	15.62	84.5

AZTEC SUBSTATION.

Vilmorin, France	U. S. D. A., No. 3941	May 1	Nov. 3	1.34	20.7	19.7	90.0
Strandes, Germany	U. S. D. A., No. 3942	do	do	1.19	21.4	20.3	88.8
Dippe, Germany	U. S. D. A., No. 3944	do	do	1.63	20.1	19.1	88.7
Mrozinski No. 1, Russia	U. S. D. A., No. 3943	do	do	1.25	21.1	20.0	90.6
Mrozinski No. 2, Russia	U. S. D. A., No. 4416	do	do	1.22	19.0	18.1	76.6
Licht Improved	F. O. Boyd, New York	do	do	1.28	20.4	19.4	87.9
Average		do	do	1.32	20.45	19.43	87.1

We believe the showing made by the Aztec substation, Santa Fe, and by other places in the Territory, is worthy of careful consideration by capitalists. In the best beet-producing sections of the Territory can be found plenty of land, water for irrigation, coal, and limestone for the maintenance of sugar factories; and the composition of the beets which can be produced in these sections is certainly very much better than that of the beets grown for most of the sugar factories now in operation.

While we believe that the yield and cost of production under field conditions can not be determined with very great accuracy when working with small experimental plots, still the figures we have secured would seem to show that satisfactory results can be secured in that connection in the best beet-producing sections of the Territory. For example, the superintendent of the Aztec substation reported yields this year, for the different varieties, ranging from 11.3 to 16 tons per acre, and estimated the cost of production per ton at $2.50.

NEW YORK.

Report by W. H. Jordan, Director of State Experiment Station, Geneva, N. Y., January 7, 1901.

Your inquiries under date of December 31 I can answer only in part.

The crop conditions of the State for 1900 were modified by an unusually severe drought. At the station very small areas were grown. The object of the experiments was to test the influence of heavy manuring in the spring with farm manures as compared with influence of commercial fertilizers upon the sugar content of the beets. For three years we have secured higher sugar content where heavy applications of farm manures have been made than under other conditions.

I do not know of any communities which are agitating the building of new factories.

Report by J. L. Stone, Assistant in Agriculture, State Experiment Station, Ithaca, N. Y., January 12, 1901.

Yours of December 31, making inquiry relative to the status of the sugar-beet industry in the State of New York, is before me. The weather conditions of the early spring were quite favorable, so that farmers got the seed sown in good season and germination was usually prompt and satisfactory. There was little difficulty from storms at this period, and farmers were enabled to get the crop well in hand with but little difficulty on account of weeds.

The middle portion of the season was very dry and the crop suffered in consequence. This was especially true in the southern section of counties where the greatest damage was done. In September abundant rain fell, and although the crop had made little growth to this time, still the plantations were in such conditions that they responded to the supply of moisture in a marked way, and the result was a crop that as to yield surpassed earlier expectations. However, the late growth was not favorable to the development of beets high in sugar content or of high purity.

A much larger area of beets was planted in the State of New York in 1900 than ever before, approximately 7,000 acres being grown. I have not the data at hand to give average results for the crop throughout the State.

As to the investigations conducted by the experiment station, the data of crops grown on the station farm have not yet been computed. We have reports from 22 farmers who conducted cooperative experiments under the supervision of the station. These experiments were for the purpose of determining the relative value of certain varieties of beets, and also the effect of different fertilizers upon the crop. The

results of the experiments with fertilizers have not yet been computed. The table given below shows results obtained with seven varieties, and the averages of all:

Results of variety tests at Ithaca Station, 1900.

Variety.	Yield per acre.	Sugar in beets.	Purity coefficient.
	Tons.	*Per cent.*	
Ziemans	14.85	13.83	80.8
Lichts	15.59	13.69	80.3
Biendorf Elite	14.09	12.40	76.0
J. Simon Le Grande	14.52	12.71	79.1
Vilmorin	11.07	13.91	78.9
Zehringen	13.92	12.04	76.4
Mangold	14.40	12.68	78.8
Average of all reports	12.63	13.04	78.6

Interest in the establishment of beet-sugar factories in this State is large and a number of communities are agitating along this line, but I am not aware of any that have come to a decision to build factories in 1901.

A comparison of the results of experiments conducted by this station during the past four seasons is given in the following table:

Results of analyses of beets grown at Ithaca Station, 1897–1900.

Season.	Yield per acre.	Sugar in beets.	Purity coefficient.
	Tons.	*Per cent.*	
1897	16.95	16.06	83.05
1898	12.38	14.52	83.60
1899	11.48	14.82	80.70
1900	12.63	13.04	78.60
Average of four years	13.51	14.61	81.48

It is probable that the average yield obtained from the experiments referred to above is somewhat above that of the general crop. The probable reason for the falling off in the quality of beets in 1900 is to be found in the climatic conditions mentioned above.

NORTH DAKOTA.

Report by E. F. Ladd, Chemist of State Experiment Station, Agricultural College, North Dakota, January 15, 1901.

Replying to your favor of January 4, I inclose a copy of my report on the sugar-beet work of North Dakota for 1900. It is not yet printed, and may not be for several months, being a part of a State document.

Answering your questions in their order, I will say that the crop conditions of the State were the poorest in several years. Wheat that should have yielded at least 60,000,000 bushels gave 12,000,000 to 15,000,000, while the hay crop was almost a total failure. Beet seed planted in May in many instances did not germinate until July, and the heavy fall rains continued the growth and prevented the maturity of the plants. Sugar-beet seed was sent to 225 farmers, well distributed over the State. But forty-nine samples of beets were furnished for analysis.

Sugar beets are not grown at the station, except for stock feed, as our land is not

adapted to growing beets of high sugar content, but gives a large yield. The Red River Valley is not a sugar-producing region, at least at the present time.

Oakes and Jamestown are working for beet-sugar factories. I am informed that the contract for the factory at Oakes has been let to a company for $587,000, and it is to conduct the factory for the first year. The capacity of the proposed factory is to be 1,000 tons of beets per day, with machinery for working up 500 tons per day.

No experiments were made at the station during the past year. The experiments continued in the State since 1891 indicate that under normal conditions where beets are well grown there should be an average of 12 to 14 tons per acre. Some of the most conservative farmers have estimated the cost at about $30 per acre for growing and harvesting the beets. The sugar content has ranged between 13 and 14 per cent for well-grown samples, and the coefficient of purity from 79 to 82. Many samples, poorly grown, not mature, prongy, and otherwise injured, have shown results from 8 per cent upward, while the best samples have given as high as 22 per cent, with a coefficient of purity above 90.

The following is from the copy for my report, to which I referred above:

SUGAR-BEET EXPERIMENTS FOR 1900.

The sugar-beet experiments in North Dakota for 1900 were almost a complete failur when compared with the results for previous years. When we consider the unusu season, and the fact that the wheat and hay crops were the poorest in the history of the State, we do not feel that the results do more than point out that an occasional poor year will occur.

Seeds were sent out to 325 farmers in all parts of the State. The season was so dry in the early summer that only 42 farmers grew any beets whatever. In many instances farmers report that the ground was so dry that seed planted in May failed to germinate u til the July rain came. The total snow and rainfall from January to July at Fargo was 6.96 inches. As the ground received but little moisture during the preceding fall, there was not enough soil moisture to insure plant growth, except where the land has been kept well cultivated to conserve the soil moisture. In very few instances was this done with the small plats of ground where beets were to be grown. In early July, beets that had started and withstood the drought began to make very rapid growth, for during the four months, July, August, September, and October, the total rainfall was 18.26 inches, or only about 1½ inches less than the average annual rainfall for Fargo for the previous nine years. The following table shows the rainfall, and the percentage of cloudy weather for the several months:

Rainfall in North Dakota, 1900.

Month.	Precipitation.	Per cent cloudy during the day.
	Inches.	
April	1.82	36
May	.81	32
June	2.11	45
July	3.91	44
August	8.28	64
September	3.27	61
October	2.80	69

The last three months show a condition very unfavorable for sugar formation, and the results are, as might be expected, very low, and not one of the forty-nine samples of beets sent in could be considered as mature. In a few instances the warm weather started a second growth with new top formation and lowered the sugar present as shown by earlier analysis.

As in previous years the beet seed was furnished by the Department of Agriculture, at Washington, and the franking privilege for sending out the seed and for bringing in the beets was granted by the Secretary of Agriculture, thus making it possible for us to continue this line of work in the State.

Five varieties of beet seed were sent out and the tabulated results for the few samples of each variety sent in are as follows:

Results of analyses of sugar beets grown in North Dakota, 1900.

Variety.	Number of beets.	Sucrose.	Coefficient of purity.
		Per cent.	
White Improved Vilmorin	26	9.80	69
Zehringen	6	9.53	64
Leichlets' Kleinwanzlebener	4	14.26	72
Dippe Bros.' Kleinwanzlebener	5	9.22	67
Russian Kleinwanzlebener	8	9.76	68
Total and averages	49	9.81	65

The beets well cared for continued to form sugar quite rapidly. Beets analyzed September 19 gave 8.14 per cent of sugar, and from the same plat those harvested October 18, or one month later, contained 14.46 per cent. Beets from another plat, for the three dates, September 29, October 7 and 28, gave the following percentages of sugar: 9.03, 13.12, and 13.44.

The repeated experiments of this station have demonstrated that North Dakota comes properly in the sugar-beet belt, and already capital has been attracted to the State for developing the industry. It is proposed to continue our sugar-beet experiments for one year more in various parts of the State, after which it is proposed to study specific problems that will prove helpful to the farmers and manufacturers, should the industry become established in the State.

OHIO.

Report by A. D. Selby, Botanist of the Ohio Experiment Station, March 23, 1901.

As will be perceived from the inclosed compilation of results of analyses of sugar beets in Ohio for 1900, the season was a very unfavorable one, the least favorable, indeed, of any of the four seasons we have conducted the cooperative work. The number of samples analyzed is greater than in 1899.

The root blight, or damping off of seedling beets, Wurzelbrand, of the Germans, was not largely complained of. In growing seedling beets in the pathologium at the station, Wooster, we have had a good deal of it, and find that it is therein due to the sterile fungus, Rhizoctonia. We have also found this fungus upon field-grown beets as well as upon potatoes.

The root rot of large beets has not been complained of to any extent. We have found unmistakable instances in our beet patches at Wooster of the occurrence of heart or dry-rot, Herz- und Trokenfäule of the Germans. This is not at all evidence as to the distribution of the trouble. We do not know to what extent it may have occurred in the beet fields, only that we have had no complaint of it.

Beet scab was more or less prevalent among the beets I observed. I found at Wooster also several examples of the crown gall of the sugar beet, and at least one grower in Sandusky County had quite a little of this trouble.

By far the most destructive disease of the season was the leaf spot, which, owing to the rainy conditions, did considerable injury to the leaves in midsummer. More extended notes have been put in the copy for a bulletin on this investigation, and if there are any other points upon which I could be of further service, I should be pleased to render that service.

The crop conditions as to stand and tonnage were very favorable in Ohio during 1900. The beets delivered to the Fremont works of the Continental Sugar Company, amounted to 21,200 tons from 2,200 acres.

Probably no additional factories will be built in Ohio during the season of 1901. Agitation has been proposed at Norwalk and Toledo.

On the experiment station grounds the tests of sugar beets were simply variety

tests. Owing to very unfavorable soil here at Wooster these results were not interesting. They are inclosed herewith.

Summary of results of analyses of sugar beets in Ohio, 1900.

County.	Number of samples.	Average weight of beets.	Sugar in beets.	Purity coefficient.
		Ounces.	*Per cent.*	
Northern section:				
Ashland	4	10.3	10.7	78.5
Cuyahoga	6	7.8	12.4	79.6
Defiance	2	5.4	13.9	83.9
Fulton	5	27.0	9.9	72.0
Hancock	1	29.1	10.9	78.1
Henry	16	11.2	13.3	82.4
Lake	4	11.1	12.9	77.0
Lorain	3	23.5	9.1	65.3
Lucas	11	12.6	11.9	81.9
Medina	22	15.3	11.7	78.5
Ottawa	1	19.5	14.8	86.7
Paulding	6	12.4	12.9	83.0
Portage	4	14.8	12.8	77.9
Putnam	12	15.1	10.2	76.2
Sandusky	17	22.6	12.9	81.6
Seneca	4	12.4	10.6	74.7
Stark	4	9.9	10.6	79.8
Summit	4	14.7	9.7	74.3
Trumbull	1	7.8	13.4	82.4
Van Wert	14	14.8	9.3	71.6
Wayne	84	8.7	10.7	77.0
Wood	1	9.8	12.1	82.5
Middle section:				
Belmont	1	6.2	14.3	83.0
Champaign	14	16.2	11.5	79.5
Clark	9	13.4	9.4	76.9
Coshocton	8	20.9	10.0	73.8
Darke	6	8.4	10.2	78.8
Delaware	4	25.0	10.0	78.0
Franklin	2	9.2	8.8	72.7
Holmes	4	20.7	13.3	81.6
Knox	2	11.4	14.5	84.2
Mercer	3	20.9	8.7	69.9
Muskingum	2	15.4	8.6	67.6
Shelby	2	9.4	12.7	80.5
Southern section:				
Fayette	2	9.7	7.5	73.9
Greene	1	9.4	9.2	69.3
Montgomery	5	23.4	8.9	66.8
Ross	4	7.0	8.9	75.2
Vinton	4	12.3	9.3	67.3
Warren	4	6.9	5.1	57.3
Summary:				
Northern section	226	12.6	11.3	77.8
Middle section	57	15.9	10.7	77.4
Southern section	20	12.5	8.1	67.5
Entire State	303	13.2	10.9	77.1

Comparison of general results for 1897, 1898, 1899, and 1900.

Section.	Number of samples.				Average weight beets in ounces.			
	1897.	1898.	1899.	1900.	1897.	1898.	1899.	1900.
Southern	67	51	20	20	31.4	18.4	21.6	12.5
Middle	132	153	18	57	32.6	19.6	23.5	15.9
Northern	355	294	93	226	29.2	25.0	20.5	12.6
Entire State	554	498	131	303	30.6	22.7	21.1	13.2

Section.	Per cent of sugar in beets.				Purity coefficient.			
	1897.	1898.	1899.	1900.	1897.	1898.	1899.	1900.
Southern	12.2	10.9	12.1	8.1	75.3	76.9	77.5	67.5
Middle	13.2	11.1	12.0	10.7	78.0	76.9	77.8	77.4
Northern	13.6	11.6	13.0	11.3	79.4	78.7	81.5	77.8
Entire State	13.3	11.4	12.7	10.9	78.7	77.9	80.2	77.1

OKLAHOMA.

Report by JOHN FIELDS, Director of Experiment Station, Stillwater, Okla., January 11, 1901.

In reply to your circular of the 5th instant, I have only to repeat my former statements concerning the possibilities of beet-sugar production in Oklahoma. The investigations of the Division of Chemistry, of experiment stations in contiguous States, and of our own experiment station all clearly show the futility of any attempt at growing sugar beets for the manufacture of sugar on a commercial scale in Oklahoma. I feel that this matter can not be stated too strongly; and general statements from official sources concerning it have been of such a nature that some of our ambitious and enterprising people have only with difficulty been prevented from launching into a beet-sugar enterprise, which would mean ruin and disaster for them and for the local agricultural interests.

The purpose of our experiments with sugar beets on the station farm during the past year was to ascertain their possibilities in providing succulent feed for our cattle and hogs during the winter months. The yield was $9\frac{3}{4}$ tons per acre. The percentage of sugar in the juice was 10 with a purity of 71.4. The seed used was that furnished by the United States Department of Agriculture.

Please say for Oklahoma that it has no possibilities to attract the beet-sugar industry. I regret it greatly, for Oklahoma grows such a great variety of crops and grows them so well that we dislike to admit the impossibility of our securing a part in this great industry that has been so largely helped by the present Secretary of Agriculture. But the results of the investigations which have shown the adaptability of other localities have shown that Oklahoma is outside of the beet-sugar belt, and it is well that the fact be at once recognized and so stated.

OREGON.

Report by A. L. KNISELY, Chemist of State Experiment Station, Corvallis, Oreg., January 16, 1901.

Your circular concerning beet industry has been referred to me. I should say the conditions were just about medium this season in Oregon, taking the State as a whole. No beets were grown at the station in 1900. The La Grande Beet Sugar Factory gives out the following:

Beets worked and sugar produced at La Grande factory, 1898–1900.

Year.	Tons of beets.	Bags of sugar.
1898	8,151	18,336
1899	11,298	22,536
1900	9,097	19,898

Newberg is working for a new factory, but there will probably be no new factories built during the next year or two.

PENNSYLVANIA.

Report by WILLIAM FREAR, Chemist of State Experiment Station, State College, Pa., January 17, 1901.

No experiments of consequence were conducted by us during the past year on the culture of the sugar beet. For several years preceding, cooperative experiments had

been conducted in different parts of the State, with the indication that both in the northern portion, where Dr. Wiley's thermal sugar-beet belt indicated that the crop could be successfully grown for sugar, and also in the lower portion, there were many localities where beets of excellent yield, richness, and purity could be obtained. These results have been confirmed by repetition, though, at least in one case, under conditions of wetness in the early season and drought in the late season, which were unfavorable to the development of the crop. It has not been thought that further work on our part at present is justified by the public interest in the sugar culture in this State.

The gentleman most interested in the study of Pennsylvania's possibilities for this industry is Mr. F. C. Bosler, an extensive landowner of Carlisle, Pa., who, several years since, was engaged in the endeavor to promote a beet-sugar manufacturing establishment to be located near Harrisburg, but I have heard nothing of this movement for a year or more, nor of any other similar movement elsewhere in the State. The facts concerning our earlier experiments are stated in bulletins of this station, from which the following extracts are made:

The general average for the State is slightly above the minimum requirements as to quality (12 per cent sugar and 80 coefficient of purity), while the yield, 15½ tons, is satisfactory.

Such averages, however, are likely to be very misleading, and a more just estimate of the bearing of the results can be obtained by a study of the several county averages. Of the 33 counties in which tests were made, 20 produced beets of satisfactory quality, and in the majority of these cases the yield was at least fairly satisfactory. In many instances, however, only one or two samples were received from a county. Results based on such a small number of trials can naturally command but little confidence. If we take the counties in which five or more trials were made, excluding Center County, where the only trials were those made on the station farm, and where the yield was very low on account of drought, we have the following results:

Results of sugar-beet experiments in ten Pennsylvania counties.

County.	Yield per acre.	Average weight of beets.	Sugar in beet.	Coefficient of purity.	Number of tests.
	Tons.	*Pounds.*	*Per cent.*		
Adams	7.50	.....	12.91	81.4	7
Bradford	13.57	1.02	13.33	82.1	5
Bucks	25.18	1.5	12.32	82.6	5
Cumberland	9.24	.....	12.08	82.0	236
Crawford	25.35	1.5	13.32	80.4	9
Franklin	8.74	.....	12.47	80.3	71
Jefferson	35.24	1.68	12.53	81.4	11
Luzerne	31.4	1.17	13.18	84.45	7
Northampton	12.96	1.98	9.36	70.0	13
Lancaster	14.43	.94	10.85	80.2	15

Of these ten counties, eight produced beets testing over 12 per cent sugar and 80 purity. Seven out of the ten also showed a yield of over 12 tons per acre.

In general, whether we consider these ten counties or the larger list, we see that the northern and northwestern counties made the best showing, both as to yield and quality. These results correspond in an interesting way with the theoretical sugar-beet belt as given in Farmers' Bulletin No. 52 of the United States Department of Agriculture.

Undoubtedly there are many instances in which the beets were harvested too early to give the best results as to quality. This affects especially Adams, Franklin, and Cumberland counties, where, in many instances, the same crop was harvested at two different dates. The averages for these counties would be raised considerably were only the later-harvested samples included.

The only decidedly adverse results were obtained in Lancaster and Northampton counties, and in the case of the former it should be noted that the results differ materially from those of 1897.

The following table shows the number of samples of beets received from each of thirty-three counties and the average results for each county:

Summary of results in Pennsylvania by counties.

County.	Yield per acre.	Average weight of beets.	Sugar in beet.	Coefficient of purity.	Number of tests.
	Tons.	*Pounds.*	*Per cent.*		
Adams	7.50	.....	12.91	81.4	67
Armstrong	19.16	1.56	12.05	80.3	4
Beaver	18.16	1.66	8.3	71.3	1
Berks	.....	.....	11.83	74.7	1
Bradford	13.57	1.02	13.33	82.1	5
Bucks	25.18	1.50	12.32	82.6	5
Center	4.68	.39	14.22	90.9	6
Chester	21.13	3.46	11.23	75	2
Cumberland	9.24	.....	12.08	82	236
Crawford	25.35	1.5	13.32	80.4	9
Columbia	.....	.....	12.77	79.8	1
Dauphin	.....	.....	11.42	84.4	2
Erie	23.85	1.13	14.35	84.7	3
Franklin	8.74	.....	12.47	80.3	71
Fulton	.....	.....	12.3	81	2
Jefferson	35.24	1.68	12.53	81.4	11
Lawrence	9.08	1.37	13.68	89.4	1
Lancaster	14.43	.94	10.85	80.2	15
Lebanon	5.18	1.78	13.82	78.8	1
Luzerne	31.40	1.17	13.18	84.45	7
Lycoming	.....	.....	14.63	87	2
Montgomery	21.28	2.26	9.17	74.1	1
Northampton	12.96	1.98	9.36	70	13
Perry	5.01	.....	13.17	82.2	1
Potter	14.97	1.05	13.83	83.3	2
Susquehanna	17.23	.52	13.7	77.7	1
Schuylkill	6.55	.18	15.05	95.1	2
Tioga	28.60	1.19	14.06	83.9	1
Union	6.05	.44	11.12	73.6	1
Venango	6.34	1.09	15.19	98.1	1
Warren	.....	.....	15.43	88	1
Westmoreland	.....	.....	11.54	77.5	2
York	.....	.....	12.81	83.7	.....
State average	15.63	1.33	12.66	81.8	.....

UTAH.

Report of Lewis A. Merrill, Agriculturist of the State Experiment Station, Logan, Utah, January 21, 1901.

In answer to your inquiry of January 5, 1901, I have the following report to make:

As a result of the unusually light snowfall during the winter, the depth of snow in the mountains was not more than one-half the usual amount. The water supply for irrigation was, therefore, limited.

A most excellent stand of beets was obtained all through the State, but the drought affected the tonnage considerably, the tonnage being only about 60 per cent of the usual product. The beet crop, however, proved its ability to withstand the drought equally as well as other crops.

Approximately 6,000 acres of sugar beets were grown for the Lehi factory and 3,000 acres for the Ogden factory. From 9,000 acres of beets something like 78,400 tons of beets were produced.

The output for the season from the factories was a trifle more than 17,200,000 pounds of sugar. At a wholesale price of $5 per sack, last season's sugar crop was worth to this State $860,000.

The purpose of the experiments with sugar beets at the Utah Experiment Station is to ascertain the effect of different methods of irrigation and varying amounts of water upon the tonnage, the sugar content, and the coefficient of purity. The results of four seasons' work is now being tabulated and will be published soon in bulletin form.

Irrigation experiment with sugar beets at Utah Experiment Station, 1900.

Plan of irrigation.	Yield per acre.	Sugar in juice. *a*	Coefficient of purity. *a*
	Tons.	*Per cent.*	
Irrigated every week	24.03	18.6	89.1
Irrigated once in two weeks	16.03	16.0	84.9
Irrigated once in three weeks	21.40	18.0	87.8
Irrigated only when beets are badly wilted	14.70	15.2	83.6
Irrigated whenever beets are slightly wilted	15.33	14.5	81.7
Irrigated three times a week	22.40	16.9	87.0

a From analyses by Dr. J. A. Widtsoe, November 24, 1900.

After a careful review of the sugar beet crop statistics for the past three years I find the average tonnage to be 12.25 tons per acre. The analysis of the entire crop from the two factories now in operation shows an average of a little over 15 per cent sugar, with a purity of 82 per cent.

From 739 analyses, made in five different years, at the Utah Experiment Station, an average of 15.43 per cent sugar in juice and 84.85 per cent purity has been obtained.

We have no statistics at hand to show the cost of production, but the average given by many of our best beet producers is $32 per acre. Many of our farmers rent land, hire help, and then make money.

Work has already commenced on the construction of a factory at Logan, in the Cache Valley. There are 40,000 acres of land in this valley, which has been shown by the Utah Experiment Station to be adapted to the culture of sugar beets. The farmers have already contracted to grow 4,000 acres of beets. The machinery has been ordered, and it is expected to have everthing in readiness for next year's crop.

The farmers of Sanpete and Sevier counties have established the fact that their soil and climate are particularly well adapted to the sugar-beet crop and that they have 2,000 farmers ready, willing, and anxious to furnish the beets for a factory. These farmers have organized for the purpose of inviting capitalists to invest in a factory, and the indications are now that they will be successful.

Practically all the seed used in the growing of beets in America is imported from France or Germany. The Utah Sugar Company at Lehi have been successfully producing seed since 1894. During the season just closed 40 tons have been produced. This is the only company in America that has been successful in the production of seed, and they intend to increase this feature of their work until enough seed is produced to supply, at least, the Utah demand.

The outlook for the sugar beet in Utah is very promising. Here, on the small irrigated farms, with intelligent labor well directed, most gratifying results can be secured from this crop.

VIRGINIA.

Report by J. L. Phillips, Assistant Entomologist, of State Experiment Station, Blacksburg, Va., January 7, 1901.

Your circular letter of December 31 in regard to sugar-beet investigation has been referred to this department, and in reply I will state that this work was discontinued several years ago on account of the many difficulties attending the same. Very few beets were grown in the State the past year and very little interest is now being taken in this line of work.

Cape Charles and Fredericksburg were agitating the establishment of factories a few years ago, but the interest has flagged, and it is not at all likely that one will be established at either place.

WISCONSIN.

Report by W. A. Henry, Director of State Experiment Station, Madison, Wis., January 5, 1901.

Replying to yours of recent date I will say that we are mailing you under separate cover two copies of the seventeenth annual report of the Wisconsin Experiment Station, just coming from the press.

The factory which was partially completed at Menominee Falls, Wis., a few years since has fallen into new hands, and contracts are being made with the farmers to grow beets the present season. No beets were grown for factory purposes in this State the past year.

The following is extracted from the report referred to above:

Results of experiments with sugar beets in Wisconsin, 1890–1899.

County.	Number of years.	Number of samples.	Average size of topped beets.	Sugar in juice.	Coefficient of purity.	Yield per acre.
			Pounds.	*Per cent.*	*Per cent.*	*Tons.*
Adams	3	11	1.4	13.92	78.6	9.7
Ashland	2	7	1.5	13.91	77.6	.....
Barron	4	25	1.3	13.71	78.0	11.6
Bayfield	1	1	2.3	10.96	73.5	16.5
Brown	4	130	2.1	13.29	77.9	15.7
Buffalo	5	19	1.6	13.64	78.3	15.7
Burnett	3	6	1.4	15.14	77.6	12.5
Calumet	6	66	1.2	16.11	79.6	13.6
Chippewa	5	54	1.4	13.98	78.1	12.3
Clark	5	90	1.3	14.46	79.7	10.7
Columbia	6	55	2.0	12.92	74.7	13.4
Crawford	4	18	2.4	12.31	77.3	12.0
Dane	5	78	2.0	13.56	74.8	16.0
Dodge	5	70	1.9	13.16	76.2	16.5
Door	4	25	1.7	15.20	79.4	12.9
Douglas	3	12	1.0	15.56	83.5	16.1
Dunn	6	50	1.6	13.41	78.5	14.3
Eau Claire	3	73	1.7	11.42	75.2	12.5
Fond du Lac	5	49	2.0	12.08	73.9	13.1
Forest	3	4	1.7	11.21	72.4	10.5
Grant	4	35	2.4	10.55	70.7	13.1
Green	4	12	1.8	11.80	73.5	18.1
Green Lake	4	16	2.1	13.38	78.4	13.8
Iowa	4	12	1.7	12.91	75.4	19.9
Iron	1	1	2.2	9.96	64.7	15.5
Jackson	4	79	1.8	13.21	77.9	8.3
Jefferson	6	61	1.7	13.83	77.5	18.4
Juneau	4	18	2.3	13.69	78.1	15.8
Kenosha	5	31	1.8	13.95	77.4	21.2
Kewaunee	6	125	2.2	14.26	77.3	12.0
La Crosse	5	80	2.1	12.40	76.6	13.9
Lafayette	4	15	1.8	13.25	74.1	14.9
Langlade	2	16	1.8	12.21	76.1	17.6
Lincoln	5	18	1.0	16.32	82.7	9.6
Manitowoc	6	77	1.8	13.95	78.9	13.8
Marathon	4	62	1.4	13.49	76.3	13.5
Marinette	4	37	2.2	12.83	75.1	17.6
Marquette	4	34	1.2	14.56	80.4	14.1
Milwaukee	5	25	1.8	14.97	79.6	17.6
Monroe	5	46	1.6	13.37	76.1	11.4
Oconto	5	33	1.5	15.16	81.5	11.6
Oneida	3	8	1.4	15.23	77.3	10.6
Outagamie	5	108	2.1	13.19	77.0	19.7
Ozaukee	6	30	1.9	13.61	79.4	14.4
Pepin	5	14	2.2	16.33	81.0	16.1
Pierce	2	14	1.6	14.26	73.4	15.0
Polk	4	11	1.5	12.56	76.5	13.7
Portage	4	43	1.8	13.28	77.3	10.4
Price	3	13	1.3	13.67	74.8	8.6
Racine	5	27	2.1	14.85	79.7	18.3
Richland	4	26	1.8	12.04	71.8	14.1
Rock	5	72	1.6	14.23	78.1	14.1
St. Croix	5	54	1.4	13.69	76.9	12.1

Results of experiments with sugar beets in Wisconsin, 1890–1899—Continued.

County.	Number of years.	Number of samples.	Average size of topped beets.	Sugar in juice.	Coefficient of purity.	Yield per acre.
			Pounds.	*Per cent.*	*Per cent.*	*Tons.*
Sauk	5	47	1.7	13.62	76.8	13.5
Sawyer	1	1	2.9	10.69	73.8	26.1
Shawano	5	37	1.5	14.40	79.5	13.5
Sheboygan	6	89	1.8	13.64	78.0	15.6
Taylor	5	27	1.3	15.57	78.5	10.8
Trempealeau	4	61	1.5	13.12	77.0	12.0
Vernon	2	37	2.3	12.55	74.5	13.1
Vilas	3	4	1.7	16.14	81.4	.....
Walworth	5	23	1.6	14.73	79.7	15.5
Washburn	3	7	1.3	12.80	77.4	13.3
Washington	6	53	1.8	15.14	80.4	15.9
Waukesha	5	76	1.8	14.68	80.0	19.1
Waupaca	5	83	2.0	13.15	76.7	12.1
Waushara	4	35	1.6	14.34	79.4	18.0
Winnebago	6	52	2.0	13.89	78.5	14.1
Wood	5	30	1.6	14.27	79.1	11.6
Unidentified	3	15	1.5	13.44	74.7	.....
Total samples	.....	2,772	.....	.....	.....	.....

Sugar beets grown at University farm, 1899.

Variety of beets.	Plat A.		Plat B.		Plat C.		Plat D.	
	Yield of beets per acre.	Sugar in beet.	Yield of beets per acre.	Sugar in beet.	Yield of beets per acre.	Sugar in beet.	Yield of beets per acre.	Sugar in beet.
	Lbs.	*Per ct.*	*Lbs.*	*Per ct.*	*Lbs.*	*Per ct.*	*Lbs.*	*Per ct.*
Vilmorin	47,330	14.9	44,280	14.3	34,230	13.4	37,700	15.0
Zehringen	40,530	13.4	39,020	16.5	30,130	14.5	38,660	16.2
Dippe Kleinwanzlebener	40,230	15.4	39,070	16.3	28,670	15.8	32,970	16.1
Mangold	37,600	13.0	38,940	16.9	32,100	13.0	36,410	15.4
Kleinwanzlebener Braune	36,490	13.3	41,930	14.0	30,890	14.6	34,100	16.6
Kleinwanzlebener K. & S	38,550	13.5	48,630	13.7	32,910	15.6	35,180	15.4
Vilmorin Neb	38,750	14.9	41,680	15.7	32,590	15.7	38,660	16.7
Kleinwanzlebener Neb	38,470	16.2	44,620	14.6	35,940	15.1	34,360	18.0
Pitzschke	38,080	10.6	47,110	15.5	38,940	14.7	35,340	16.5
Rölker Z Z	39,600	15.7	48,950	13.8	39,310	14.6	38,870	16.5
Rölker E E	39,730	13.0	48,180	15.3	39,750	15.2	36,070	17.3
Rölker Dippe	41,690	14.6	49,030	15.2	39,430	14.9	40,310	17.0
Vilmorin	51,560	15.2	57,580	13.7	43,750	13.9	41,330	15.3
Averages and total	40,662	14.68	45,309	14.95	35,280	14.63	36,920	16.29

Variety of beets.	Plat E.		Total for whole field and for all varieties.				
			Yield of beets.		Sugar.		
	Yield of beets per acre.	Sugar in beet.	From plat.	Per acre.	From plat.	Per acre.	Per cent.
	Lbs.	*Per ct.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
Vilmorin	37,530	16.8	3,744.3	39,300	565.9	5,937	15.11
Zehringen	29,050	16.2	1,099.3	34,830	170.8	5,411	13.53
Dippe Kleinwanzlebener	29,800	17.0	1,064.7	35,740	172.7	5,470	16.21
Mangold	28,870	16.6	1,082.4	34,300	164.8	5,220	15.23
Kleinwanzlebener Braune	28,780	17.4	1,073.6	34,020	165.6	5,247	15.43
Kleinwanzlebener K. & S	29,610	15.3	1,147.1	36,340	169.0	9,355	14.73
Vilmorin Neb	30,590	16.3	1,136.6	36,000	181.3	5,744	15.95
Kleinwanzlebener Neb	29,980	16.6	1,140.6	36,130	183.1	5,801	16.05
Pitzschke	29,150	16.2	1,167.2	36,980	187.4	5,936	16.05
Rölker ZZ	28,080	17.4	1,195.6	37,870	187.6	5,930	15.69
Rölker EE	28,790	16.1	1,185.7	37,580	185.2	6,005	15.62
Rölker Dippe	30,210	18.1	1,236.1	39,150	199.4	6,319	16.14
Vilmorin	33,060	14.9	2,747.5	43,530	398.8	6,319	14.52
Average and total	30,269	16.58	19,020.7	37,660	2,931.6	5,805	15.41

The average contents of sugar in the beet for all varieties for the different plats were as follows: Plat A, 14.68 per cent; Plat B, 14.95 per cent; Plat C, 14.63 per cent; Plat D, 16.29 per cent; and Plat E, 16.58 per cent; the average calculated yields of sugar per acre were 5,965, 6,771, 5,162, 6,013, and 5,017 pounds for Plats A, B, C, D, and E, respectively. We notice, therefore, that the yield of beets from the plat that received farmyard manure (B) was so much higher than the yields on the other plats that, in spite of the fact that these beets were considerably lower in sugar content than the beets from at least two of the other plats, the yield of sugar was increased at the rate of over 1,200 pounds per acre above the average yields for the plats not fertilized, and the yield of beets was increased at the rate of 5 tons per acre.

REPORT OF THE CHEMIST,

H. W. WILEY.

LETTER OF SUBMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF CHEMISTRY,
WASHINGTON, D. C., *February 21, 1901.*

SIR: I beg to transmit herewith the tabulations of the results of analyses of sugar beets from the District of Columbia and the different States and Territories during the season of 1900.

Respectfully,

H. W. WILEY,
Chief of the Division of Chemistry.

Hon. JAMES WILSON,
Secretary of Agriculture.

RESULTS OF ANALYSES OF SUGAR BEETS GROWN IN 1900.

The table following contains the results of analyses made in the laboratory of the Division of Chemistry, United States Department of Agriculture. The beets analyzed were secured from two sources: (1) The crop grown on the experimental grounds of the Department; (2) the experimental plats of individual growers scattered throughout the country to whom the Department sent sugar-beet seed. Much the greater portion came from the latter source.

The tabulations are made in the usual form, and show the number of samples received from each State and Territory, the weight of the beets, their content of sugar, the purity coefficients of the juice, and other data necessary to form an intelligent judgment concerning the character of the beets for sugar-making purposes.

The data from the different States and Territories are tabulated by counties, and the location of the county in the State is indicated. The study of these data is of great interest, as showing the character of beets grown under substantially the same cultural conditions in all parts of the United States.

Results of analyses of sugar beets at the chemical laboratory of the Department of Agriculture during the year 1900, by States.

[The symbol following name of county indicates the location of the county within the State, as follows: □, central; ⊓, northern; □-, eastern; ⊔, southern; -□, western ⊓, northwestern; ◸, northeastern; ◿, southeastern; ◺, southwestern.]

Serial number.	State or Territory and county.	Post-office.	Experimenter.	Variety.	When harvested.	Average weight.	Sugar in the beet.	Purity coefficient.	Was season favorable?
	ARKANSAS.					*Ounces.*	*Per cent.*		
289	Drew ◻	Grove	E. J. Barker		Sept. 17	5	7	60.6	No.
130	Madison ◺	Crosses	J. Barker	Kleinwanzlebener (Dippe)	Sept. 3	13	6.4	62.6	No.
	State averages (2 samples).					9	6.7	61.6	
	CALIFORNIA.								
214	Mendocino -□	Potter Valley	H. Henies	Vilmorin's Improved	Sept. 14	6	12.4	79.3	No.
297	Modoc ⊓	Lookout	L. C. Carpenter	do	Sept. 15	15	10.9	70.5	No.
780	San Bernardino ◻	Ontairo	J. N. Mills		Oct. 23	6	14.4	82.1	No.
575	Santa Cruz -□	Ben Lomond	D. R. Guilhard	Vilmorin's Improved	Oct. 10	25	13.7	83.7	No.
	State averages (4 samples).					13	12.9	78.9	
	COLORADO.								
288	Arapahoe □	Denver	C. P. Heintz	Kleinwanzlebener (Dippe)	Sept. 16	23	13.1	80.2	Yes.
312	do	do	L. J. Prince	Vilmorin's Improved	Sept. 19	26	11.1	74.6	No.
508	do	Harman	Mrs. K. Kinzy	do	Oct. 5	13	14.5	80.9	Yes.
722	do	Hope	J. C. Cope		Oct. 22	38	10	69.1	Yes.
257	Boulder ⊓	Gorham	C. M. Pruden	Vilmorin's Improved	Sept. 10	31	10.6	75	No.
277	Delta -□	Delta	H. Walther	Kleinwanzlebener (Dippe)	Sept. 20	33	12.6	72.6	Yes.
359	Douglas □	Castlerock	D. C. Dormer	do	Sept. 26	9	12.2	70.3	No.
838	Elbert □-	Elbert	C. H. L. Shutz	do	Nov. 5	13	10.6	71.2	No.
847	do	do	do	do	do	19	11.4	76.4	No.
510	El Paso □	Husted	W. T. Wilson	do	Oct. 6	25	9.9	70.7	Yes.
862	do	do	do	Vilmorin's Improved	Nov. 3	17	10.3	75.5	No.
970	do	do	do	do	Nov. 26	16	13.9	83.9	No.
325	Garfield ◺	Silt	W. C. Parker	Kleinwanzlebener (Dippe)	Sept. 20	16	9.1	69.6	No.
327	do	do	do	do	do	24	10.9	70.5	No.
697	do	Antlers	C. H. Miller	Vilmorin's Improved	Oct. 21	14	12.2	71.9	No.
915	Jefferson □	Golden	C. H. Flucken	Kleinwanzlebener	Nov. 16	15	13.5	82.5	No.
585	La Plata ◿	Bayfield	Mrs. E. Hammond		Oct. 15	33	12.5	73.6	Yes.
357	Mesa -□	Fruita	S. L. Coulter	Kleinwanzlebener (Dippe)	Sept. 23	25	13	81.1	Yes.
344	do	Rhone	J. Buniger	do	Sept. 24	13	14.9	82.2	Yes.
484	do	Whitewater	C. Russell	Vilmorin's Improved	Oct. 4	16	12.6	76	No.
486	do	Rhone	J. Lind	do	Oct. 1	29	16.4	81.6	Yes.

418	....do	Grand Junction	E. M. Slocomb		Sept. 30	24	12.6	68.9	Yes.
580	....do	Fruita	E. W. Terrill	Vilmorin's Improved	Oct. 15	67	15.8	83.4	Yes.
538	....do	Clover	T. B. Sanford		Oct. 9	25	14	81.7	No.
541	....do	....do	....do		....do	27	14.3	82	No.
716	....do	Whitewater	C. Russell	Vilmorin's Improved	Oct. 21	15	13.2	77.2	No.
781	....do	Grand Junction	J. L. Longaker	....do	Oct. 26	21	17.4	84.7	Yes.
805	....do	....do	M. P. Smith	....do	Oct. 29	42	12.5	75.8	Yes.
831	....do	....do	A. B. Hawkins	Kleinwanzlebener	Nov. 2	15	16.7	88	Yes.
836	....do	Fruita	W. J. Goss	....do	Nov. 5	48	11.9	71	Yes.
848	....do	....do	....do	....do	....do	59	13.6	80.3	Yes.
851	....do	....do	F. Berg	....do	Nov. 6	48	11.9	74.5	Yes.
854	....do	Grand Junction	J. L. Longaker	Vilmorin's Improved	Nov. 5	18	15	78.6	No.
958	....do	Fruita	E. C. Eggleston	....do	Nov. 19	25	13.4	77.5	Yes.
561	Otero □	Rockyford	Arkansas Valley Experiment Station.	Kleinwanzlebener	Oct. 10	24	15.6	83.7	Yes.
526	....do	....do	....do	....do	Oct. 15	24	13.8	80.1	Yes.
556	....do	....do	....do	....do	....do	21	13.4	79.5	Yes.
612	....do	....do	J. C. Kain	....do	Oct. 19	27	14.8	77.2	Yes.
619	....do	....do	G. Lackey	....do	Oct. 20	18	17.4	82.4	Yes.
620	....do	....do	....do	....do	Oct. 21	21	14.5	77.6	Yes.
701	....do	....do	J. C. Kain	....do	Oct. 22	30	15.8	78.7	Yes.
771	....do	....do	C. J. Samples	....do	Oct. 17	37	16.8	82.7	Yes.
783	....do	Ordway	E. H. Van Oman	Kleinwanzlebener	Oct. 27	24	16.9	85.6	Yes.
773	....do	Rockyford	E. Clark	....do	Oct. 23	28	16.9	82.4	Yes.
993	....do	Sugar City	National Sugar Co.	....do	Nov. —	16	18.6	84.4	Yes.
994	....do	....do	....do	....do	Nov. —	21	18.7	85.9	Yes.
995	....do	....do	....do	....do	Nov. —	20	19.2	86	Yes.
996	....do	....do	....do	....do	Nov. —	18	19.4	87.7	Yes.
997	....do	....do	....do	....do	Nov. —	22	19.3	86.7	Yes.
998	....do	....do	....do	....do	Nov. —	17	19.9	88.3	Yes.
999	....do	....do	....do	....do	Nov. —	19	19	84.2	Yes.
525	Prowers □	Amity	D. H. Coker		Oct. 9	23	15.4	83.1	Yes.
553	....do	....do	E. E. Erikson		....do	18	10.6	68.7	Yes.
889	....do	Holly	W. F. Crowley	Kleinwanzlebener	Nov. 8	28	11.5	75.2	Yes.
351	Routt ⊏	Trull	Wm. J. M. Clausland	Vilmorin's Improved	Sept. 24	24	12.8	76.3	No.
428	....do	Yampa	N. Mandall	....do	Sept. 29	17	14.1	75.9	Yes.
823	Teller □	Marigold	H. Hockett	....do	Oct. 31	33	14.2	81	No.
	State averages (57 samples).					25	14.1	78.7	
	CONNECTICUT.								
363	Fairfield ⊐	Darien	J. W. Mather	Vilmorin's Improved	Oct. 1	20	10	73.4	No.
	State averages (1 sample).					20	10	73.4	
	DELAWARE.								
543	Sussex ⊓	Coolspring	G. A. Coberdale		Oct. 11	15	10	75.6	No.
	State averages (1 sample).					15	10	75.6	

Results of analyses of sugar beets at the chemical laboratory of the Department of Agriculture during the year 1900, by States—Continued.

Serial number.	State or Territory and county.	Where grown.	Plot.	Variety.	When harvested.	Average weight.	Sugar in the beet.	Purity coefficient.
	DISTRICT OF COLUMBIA.							
						Ounces.	*Per cent.*	
.....	District of Columbia	Experimental grounds, Department of Agriculture.	Plot No. 501	White Improved Vilmorin, S. P. I. No. 3941.	Sept. 19	10	10.1	.....
.....	do	do	do	do	Sept. 24	12.7	10.1	72.6
.....	do	do	do	do	Oct. 3	11.8	8.6	73.4
.....	do	do	do	do	Oct. 9	13.2	8.6	75
.....	do	do	do	do	Oct. 15	12	8.2	66.6
.....	do	do	do	do	Oct. 22	13.4	7.8	65.6
.....	do	do	do	do	Oct. 30	12.7	7.5	64.7
.....	do	do	do	do	Nov. 6	12.8	8.9	72.3
.....	do	do	do	do	Nov. 13	16.1	7.6	65.6
.....	do	do	do	do	Nov. 19	13.3	8	65.7
.....	do	do	do	do	Nov. 27	12.2	8.6	67.2
.....	do	do	do	do	Dec. 3	11.2	9.7	72.3
.....	do	do	do	do	Dec. 11	10.7	8.6	69.5
	Averages for this variety (13 samples).					12.5	8.6	69.2
.....	District of Columbia	Experimental grounds, Department of Agriculture.	Plot No. 502	White Queen of the North	Sept. 19	10.4	9.8	.....
.....	do	do	do	do	Sept. 24	11.1	10.9	74.7
.....	do	do	do	do	Oct. 3	10.5	9.6	73.2
.....	do	do	do	do	Oct. 9	11	8.9	71.2
.....	do	do	do	do	Oct. 15	12.3	9.2	70.8
.....	do	do	do	do	Oct. 22	11.6	8.6	70.9
.....	do	do	do	do	Oct. 30	11.6	8.6	73.2
.....	do	do	do	do	Nov. 6	11.5	9.3	75.4
.....	do	do	do	do	Nov. 13	14.1	8.9	71.2
.....	do	do	do	do	Nov. 19	13.4	9	71.4
.....	do	do	do	do	Nov. 27	11.1	9.3	71
.....	do	do	do	do	Dec. 3	19.6	9.4	74.4
.....	do	do	do	do	Dec. 11	16	10.1	75.2
	Averages for this variety (13 samples).					12.6	9.4	72.7
.....	District of Columbia	Experimental grounds, Department of Agriculture.	Plot No. 503	White Improved Vilmorin	Sept. 19	11.9	9.8	.....
.....	do	do	do	do	Sept. 24	12	10.6	77.3
.....	do	do	do	do	Oct. 3	9.3	9.7	73.9
.....	do	do	do	do	Oct. 9	10.9	9.3	72.6
.....	do	do	do	do	Oct. 15	11.8	9.2	71.3

do	do	do	do	Oct. 22	11.8	8.6	72
do	do	do	do	Oct. 30	13.5	8.5	71.2
do	do	do	do	Nov. 6	13.8	8.6	70.3
do	do	do	do	Nov. 13	15.1	8.5	69
do	do	do	do	Nov. 19	12.5	9.3	73.1
do	do	do	do	Nov. 27	13.5	9.2	72.4
do	do	do	do	Dec. 3	18.6	9.4	72.8
do	do	do	do	Dec. 11	17.5	9.1	72.3
Averages for this variety (13 samples).					13.2	9.2	72.4
District of Columbia	Experimental grounds, Department of Agriculture.	Plot No. 505.	White Improved Vilmorin, S. P. I. No. 3911.	Sept. 19	9.9	9.8	
do	do	do	do	Sept. 24	11.4	10.2	73.3
do	do	do	do	Oct. 3	12.6	9.4	72.8
do	do	do	do	Oct. 9	16.1	8.7	69.2
do	do	do	do	Oct. 15	11	8.1	66.4
do	do	do	do	Oct. 22	16.2	7.9	68.6
do	do	do	do	Oct. 30	14.1	7.9	67.5
do	do	do	do	Nov. 6	13.1	7.4	67.8
do	do	do	do	Nov. 13	12.9	7.5	64.2
do	do	do	do	Nov. 19	13.2	8.3	68
do	do	do	do	Nov. 27	15	8.1	66.4
do	do	do	do	Dec. 3	20.4	7.4	65
do	do	do	do	Dec. 11	17.3	8.1	66.4
Averages for this variety (13 samples).					14.1	8.4	68.1
District of Columbia	Experimental grounds, Department of Agriculture.	Plot No. 506.	S. P. I. 3942, Zehringen (Strandes).	Sept. 19	12.7	9.8	
do	do	do	do	Sept. 24	13.1	9.6	73.7
do	do	do	do	Oct. 3	13.4	9.6	79.6
do	do	do	do	Oct. 9	16.2	8.1	68.6
do	do	do	do	Oct. 15	14.6	7.6	66.1
do	do	do	do	Oct. 22	12	8	68.9
do	do	do	do	Oct. 30	13.8	7.8	68.9
do	do	do	do	Nov. 6	17.3	7.7	71.7
do	do	do	do	Nov. 13	17.3	7.4	64
do	do	do	do	Nov. 19	15.8	7.7	67.5
do	do	do	do	Nov. 27	15.9	8.1	67
do	do	do	do	Dec. 3	22	8.7	74.2
do	do	do	do	Dec. 11	21	8.5	70.1
Averages for this variety (13 samples).					15.8	8.4	70
District of Columbia	Experimental grounds, Department of Agriculture.	Plot No. 507.	S. P. I. 3943, Kleinwanzlebener (Mrozinski).	Sept. 19	11.8	9.5	
do	do	do	do	Sept. 24	12	9.7	72.8
do	do	do	do	Oct. 3	10.8	8.3	69.6

Results of analyses of sugar beets at the chemical laboratory of the Department of Agriculture during the year 1900, by States—Continued.

Serial number.	State or Territory and county.	Where grown.	Plot.	Variety.	When harvested.	Average weight.	Sugar in the beet.	Purity coefficient.
	DISTRICT OF COLUMBIA—continued.							
						Ounces.	*Per cent.*	
.....	District of Columbia	Experimental grounds, Department of Agriculture.	Plot No. 507	S. P. I. 3943, Kleinwanzlebener (Miozinski).	Oct. 9	12.6	8	67.2
.....	do	do	do	do	Oct. 15	11.2	7.8	65.6
.....	do	do	do	do	Oct. 22	15.2	7.4	66.7
.....	do	do	do	do	Oct. 30	14.1	7.4	67.2
.....	do	do	do	do	Nov. 6	16.1	7.3	67.5
.....	do	do	do	do	Nov. 13	16.1	6.6	62.2
.....	do	do	do	do	Nov. 19	8.9	7.5	65.8
.....	do	do	do	do	Nov. 27	12.2	7.5	64.2
.....	do	do	do	do	Dec. 3	23.2	8	66.7
.....	do	do	do	do	Dec. 11	11.7	9.3	73.1
	Averages for this variety (13 samples).					13.5	8	67.4

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Serial number.	State or Territory and county.	Post-office.	Experimenter.	Variety.	When harvested.	Average weight.	Sugar in the beet.	Purity coefficient.	Was season favorable?
	GEORGIA.								
						Ounces.	*Per cent.*		
266	Forsyth ⊔	Storeville	J. H. Jones	Kleinwanzlebener (Dippe)	Sept. 14	10	14.2	86.6	No.
	State averages (1 sample).					10	14.2	86.6	
	IDAHO.								
535	Bingham ◫	Iona	C. W. Rockwood	Vilmorin's Imroved	Oct. 8	60	12.8	88.2	Yes.
536	do	do	do	Kleinwanzlebener	do	50	10.6	64.9	Yes.
148	Canyon ⊏	Caldwell	J. A. Walker	Vilmorin's Improved	Sept. 5	20	12.7	77 9	Yes.
5 11	do	do	do	do	Oct. 5	11	16.2	84.2	Yes.

361	Fremont	Parker	J. Horner		Sept. 27	28	13.7	82.7	Yes.
362	do	St. Anthony	C. E. Miller		Sept. 29	12	11.5	83.6	No.
356	do	Wilford	G. A. Pincock	Kleinwanzlebener (Dippe)	Sept. 24	18	12.5	78.6	No.
341	do	Tilton	J. M. Baker	do	do	33	16.9	88.1	Yes.
590	do	Rexburg	H. Picks	do	Oct. 15	32	14.1	80.8	Yes.
513	do	Parker	J. T. B. Mason	do	Oct. 6	20	13.8	86.8	Yes.
566	do	Rexburg	C. Keppner	do	Oct. 12	46	10.2	74.8	Yes.
545	do	Edmunds	R. Hamsley		Oct. 8	7	11.8		Yes.
775	do	do	do		Oct. 23	16	15.1	87.1	No.
741	do	Rexburg	T. Bassett		Sept. 19	63	11.5	79.6	Yes.
714	do	do	J. A. Stephens	Kleinwanzlebener	Oct. 20	9	12.5	83.1	Yes.
964	do	St. Anthony	C. E. Miller	Kleinwanzlebener (Mroziuski)	Oct. 28	21	11.3	79.9	Yes.
971	do	do	do	do	Nov. 20	6	15.6	90.6	Yes.
957	Idaho	Ferdinand	P. Aschenbremen	Vilmorin's Improved	Nov. 16	29	13.1	77.9	Yes.
959	do	do	do	do	do	21	13.6	76.9	Yes.
	State averages (19 samples).					26	13.5	81.1	
	ILLINOIS.								
324	Champaign	Rantoul	H. B. Clark	Vilmorin's Improved	Sept. 24	52	6.7	53.8	Yes.
323	do	do	do	do	do	11	5.7	59.1	Yes.
532	Clinton	New Memphis	J. G. Loschert		Oct. 10	32	8.1	68.2	Yes.
550	do	do	do		do	31	7.1		Yes.
296	Cook	Harvey	W. J. Massingham	Kleinwanzlebener (Dippe)	Sept. 17	16	6.9	65.2	Yes.
348	do	do	do	do	Sept. 27	11	8.8	69	Yes.
552	do	South Holland	C. Dalenberg	do	Oct. 10	50	11	73.9	Yes.
592	do	Oak Glen	J. Riefeld	Vilmorin's Improved	Oct. 16	19	10.7	72.5	Yes.
856	do	do	do	do	Nov. 6	17	12.9	79.1	Yes.
828	do	Thornton	P. M. Stegenga	Kleinwanzlebener	Nov. 5	12	12.5	79	Yes.
276	Johnson	Goreville	J. C. Trovillion		Sept. 17	23	6.3	62.8	No.
956	Kane	Elgin	P. Whipple		Nov. 28	13	10.6	73.2	
141	Morgan	Nortonville	E. L. Whittock	Vilmorin's Improved	Sept. 6	23	6.8	68.6	Yes.
602	Randolph	Schuline	H. C. Hagen	do	Oct. 19	15	7.3	64.2	No.
207	St. Clair	Millstadt	N. Rohr		Sept. 9	13	5.7	30.5	Yes.
871	Warren	Monmouth	E. C. Linn		Nov. 10	25	6.1	59.3	Yes.
	State averages (16 samples).					27	8.3	65.2	
	INDIANA.								
346	Elkhart	Elkhart	B. F. Oakes	Vilmorin's Improved	Sept. 26	27	12.1	79.9	No.
533	Henry	Lewisville	J. Parker		Oct. 8	7	9.1	71.1	Yes.
126	Knox	Fritchton	E. Smaw	Straudes' Zehringen	Sept. 3	31	7.1	65.8	No.
598	Laporte	Laporte	E. Rechenberg	Vilmorin's Improved	Oct. 20	26	6.9	60.8	Yes.
817	do	do	do	do	Nov. 3	21	9.1	69.1	Yes.
378	Marshall	Tyner	M. Chase	Kleinwanzlebener (Dippe)	Sept. 30	18	7.9	70.3	Yes.
582	Noble	Rome City	G. A. Stroup, M. D.	Vilmorin's Improved	Oct. 17	16	10.7	79	Yes.
328	Pulaski	Medaryville	G. Hausen	do	Sept. 24	15	9.3	66.2	No.
830	Ripley	Crossplains	J. Vanosdal	do	Nov. 5	12	10.1	71.6	Yes.

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Serial number.	State or Territory and county.	Post-office.	Experimenter.	Variety.	When harvested.	Average weight.	Sugar in the beet.	Purity coefficient.	Was season favorable?
	INDIANA—continued.					*Ounces.*	*Per cent.*		
259	Shelby □	Morristown	A. V. Wagoner	Vilmorin's Improved	Sept. 14	23	8.8	71	Yes.
724	do	Waldron	Wm. R. Neuton		Oct. 25	37	5.7	52.6	Yes.
515	Starke ⊓	San Pierre	Mrs. P. Kramer	Vilmorin's Improved	Oct. 8	15	11.3	82	Yes.
683	Steuben ◪	Ray	B. J. Bohner	do	Oct. 22	31	11.3	76.8	Yes.
648	do	do	do	do	do	27	13	79.7	Yes.
471	Wabash ⊓	Roann	W. P. Carpender	do	Sept. 4	10	8.6	70	Yes.
	State averages (15 samples).					21	9.4	71.1	
	INDIAN TERRITORY.								
123	Cherokee Nation ⊓	Stilwell	L. Davis	Vilmorin's Improved	Sept. 1	6	11	81.1	No.
320	Chickasaw Nation ⊔	Leon	R. M. Brown	Strandes' Zehringen	Sept. 16	30	7.2	63.8	No.
129	Choctaw Nation ⊔	Durant	K. R. Underwood	Kleinwanzlebener (Dippe)	Sept. 3	51	5.5	53.7	Yes.
	Averages (3 samples)					29	7.9	66.2	
	IOWA.								
433	Adams ⊔	Prescott	C. S. Crouse	Vilmorin's Improved	Oct. 3	32	7.5	52.7	No.
340	Allamakee ◪	Waukon	A. C. Johnson	Kleinwanzlebener (Dippe)	Sept. 24	26	8.6	70	Yes.
372	do	Ion	C. Kelly		Sept. 30	32	10.8	76	No.
600	Boone □	Boone	J. S. Friedley	Strandes' Zehringen	Oct. 17	44	9.3	70	No.
653	Cerro Gordo ⊓	Mason City	J. P. Calom	Vilmorin's Improved	Oct. 22	41	9.2	63	Yes.
651	do	do	T. Butts	do	do	57	9.5		Yes.
269	Cherokee ⊓	Cherokee	W. M. Little		Sept. 15	15	8.8	72.1	No.
360	do	do	Z. Wellman	Vilmorin's Improved	Sept. 29	27	9	71.4	No.
205	Clayton ◪	Gunder	R. Southwell	Kleinwanzlebener (Dippe)	Sept. 10	26	9.1	71.6	No.
298	do	Guttenberg	E. Goetz	Vilmorin's Improved	Sept. 20	13	7.6	67.2	No.
287	do	Updegraff	L. A. Oldham	do	Sept. 17	22	13	77.9	Yes.
309	do	Gunder	R. Southwell	Kleinwanzlebener (Dippe)	Sept. 20	30	10.1	72.6	No.
345	do	Garnavillo	A. Kregel	Vilmorin's Improved	Sept. 26	19	9.9	71.7	Yes.
850	do	do	E. W. Koegel	do	Nov. 5	64	10.1	73.6	No.
853	do	do	do	do	do	58	10.5	74.8	No.
877	do	do	H. Schlake	do	Nov. 10	33	8.3	66.9	Yes.
353	Crawford ⊏	Dow City	Wm. Jenkins		Sept. 24	33	6.4	60.9	Yes.
352	do	do	do		do	28	8.5	69	Yes.
483	Fayette ◪	Hawkins	B. S. Bennin	Kleinwanzlebener	Sept. 5	23	9.1	69.6	Yes.

818	Franklin	Sheffield	B. Thrassel	do	Nov. 2	24	9.7	72.9	No.
349	Hancock	Goodell	J. B. Cundiff	Kleinwanzlebener (Dippe)	Sept. 28	46	9.4	69.2	Yes.
591	do	Butt	J. E. Gifford	do	Oct. 16	27	10.7	72.9	No.
804	Jackson	Sabula	Seiber & Simpson		Oct. 27	32	6.4	61.9	No.
810	Marion	Tracy	W. K. Rouze	Kleinwanzlebener	Nov. 3	12	7.5	63.4	No.
728	Montgomery	Stanton	A. Trabert	Vilmorin's Improved	Oct. 21	27	8.8	67.9	No.
527	Sac	Early	F. Tauk		Oct. 9	24	8.5	70	Yes.
589	Shelby	Irwin	G. E. Stevenson	Vilmorin's Improved	Oct. 16	16	9.7	74.5	No.
871	Story	Ames Express Station.	J. Atkinson	Kleinwanzlebener (Australian Special).	Nov. 6	13	11.7	76.9	
339	Webster	Moorland	L. H. Fiala		Sept. 24	40	9.3	71.5	Yes.
479	do	Fort Dodge	P. J. Schultz	do	Oct. 1	50	7.7	64.8	Yes.
616	do	Badger	A. Chaulland	Knauer's Mangold	Oct. 17	20	14.4	82.1	No.
757	do	Fort Dodge	Becker Bros	do	Oct. 23	32	11.5	78	No.
792	do	do	L. W. Nendick		Oct. 29	28	10.8	74	Yes.
910	do	Moorland	J. H. Fiala		Nov. 1	24	12.4	79.8	Yes.
770	Winnebago	Buffalo Center	C. E. Mallory		Oct. 25	65	9.7	73.9	No.
811	do	Lake Mills	T. J. Helgensen		Nov. 3	42	10	71.4	No.
274	Winneshiek	Castalia	A. H. Upley		Sept. 18	46	8.3	71.9	No.
336	do	Spillville	A. Roidor		Sept. 23	15	10.6	76.6	No.
892	Worth	Grafton	G. Kruger		Nov. 1	90	6.3	61.1	No.
	State averages (39 samples).					33	9.5	70.7	
	KANSAS.								
275	Allen	Laharpe	E. D. Kramer	Kleinwanzlebener (Dippe)	Sept. 17	41	12.6	72.6	Yes.
962	do	do	do	do	Nov. 24	35	12	75	No.
71	Bourbon	Fort Scott	W. C. Gunn	do	Aug. 10	22	10.9	68	No.
321	do	Godfrey	A. Hunley	Vilmorin's Improved	Sept. 22	13	9.9	74.3	No.
551	do	Fort Scott	H. E. Russell	Kleinwanzlebener	Oct. 9	17	8.8	71.5	Yes.
573	do	Godfrey	A. Hunley	Vilmorin's Improved	Oct. 13	11	10.5	76.9	Yes.
876	do	do	do	do	Nov. 9	16	9.6	71.1	Yes.
878	do	Fort Scott	L. Schlinger	do	do	28	8.8	22.4	Yes.
953	do	do	W. C. Gunn	Kleinwanzlebener	Nov. 10	9	12.5	78.9	No.
955	do	do	H. W. Hughes	do	do	13	8.2	67.7	No.
950	do	do	Ira Moore	do	do	18	8.9	61.8	No.
581	Decatur	Bassettville	O. P. Ecord	do	Oct. 15	39	11.9	74.5	No.
145	Ellsworth	Ellsworth	J. Morton	Kleinwanzlebener (Dippe)	Sept. 8	20	8.9	68.6	No.
281	Johnson	Olathe	S. F. West	do	Sept. 18	43	6.3	57.9	Yes.
170	Leavenworth	Mount Olivet	F. W. Toff	Vilmorin's Improved	Sept. 11	21	9.7	76.7	No.
782	Marshall	Marysville	J. Seematler	Kleinwanzlebener	Oct. 27	46	11.4	75.9	No.
819	do	do	do	do	Nov. 2	39	11.3	74.9	No.
914	do	Bremen	J. Stohs		Nov. 17	27	8.4	67.2	Yes.
609	Stevens	Hugoton	M. Traver	Kleinwanzlebener	Oct. 15	2	7.6		Yes.
742	Washington	Hanover	H. Huehring	do	Oct. 25	30	13	81.1	Yes.
	State averages (20 samples).					25	10.1	72.1	

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Serial number.	State or Territory and county.	Post-office.	Experimenter.	Variety.	When harvested.	Average weight.	Sugar in the beet.	Purity coefficient.	Was season favorable?
	KENTUCKY.					*Ounces.*	*Per cent.*		
940	Fayette □	Lexington	Kentucky Agricultural Experiment Station.	Kleinwanzlebener (Mrozinski)	Nov. 19	9	8.5	69	Yes.
941	do	do	do	Licht's Zuckerreichste	do	9	8.8	70.4	Yes.
945	do	do	do	Vilmorin's Improved	do	9	9.1	70.6	Yes.
929	do	do	do	Kleinwanzlebener	do	9	10.9	75.2	Yes.
933	do	do	do	Strandes' Zehringen	do	12	10	77.2	Yes.
937	do	do	do	White Queen of the North	do	10	8.6	73.2	Yes.
939	do	do	do	Kleinwanzlebener (Austrian Special).	do	9	7.9	68	Yes.
733	Grayson -□	Falls of Rough	R. C. Beauchamp	Kleinwanzlebener	Oct. 23	3	9.3	.....	No.
406	Nelson □	Highgrove	D. P. Stallard		Oct. 2	40	5.1	27.1	Yes.
319	Warren ⊓	Bowling Green	M. M. Ennis	Kleinwanzlebener (Dippe)	Sept. 21	13	10	75.5	No.
318	do	do	do	do	do	18	9.5	74.1	No.
133	do	do	D. Handy	Strandes' Zehringen	Sept. 5	12	3.8	32.8	Yes.
	State averages (12 samples).					13	8.5	64.8	
	MAINE.								
391	Penobscot □	Hampden Corner	R. W. Muidi		Sept. 29	18	9.1	72.2	Yes.
392	do	do	do		do	20	7	63.2	Yes.
	State averages (2 samples).					19	8.1	67.7	
	MARYLAND.								
815	St. Mary ⊓	Beauvne	G. F. Dyer		Nov. 1	10	9.3	74.2	No.
	State averages (1 sample).					10	9.3	74.2	
	MASSACHUSETTS.								
908	Plymouth ⌞	Plymouth	E. E. Avery	Vilmorin's Improved	Nov. 15	9	13.9	.....	Yes.
907	do	do	do	Kleinwanzlebener	Nov. 16	6	14.1	.....	No.
	State averages (2 samples).					8	11	.....	

	MICHIGAN.									
698	Allegan	Hilliards	W. C. Miles	Kleinwanzlebener	Oct. 23	22	12.8	79	Yes.
837	....do	....do	....do	....do	....do	21	12	80.8	Yes.
790	Antrim	Bellaire	O. B. Orcutt	....do	Oct. 30	31	14	82.1	Yes.
710	Barry	Woodland	J. H. Sawdy	....do	Oct. 23	42	10	68.6	Yes.
732	Bay	Loehne	E. Loehne	....do	Oct. 24	43	12.9	82.4	Yes.
306	Benzie	Nessen City	C. F. Pulsifer	Vilmorin's Improved	Sept. 21	18	11.7	79.9	Yes.
801	....do	Lake Ann	W. F. Shutt	Kleinwanzlebener	Oct. 31	26	13.2	80.8	Yes.
849	....do	Benzonia	E. B. Judson		Nov. 6	23	11.2	72.4	Yes.
987	Berrien	Threecoaks	A. Sherwood	Kleinwanzlebener	Dec. 8	23	10.4	77.9	No.
416	Calhoun	Bedford	C. F. Booker	Strandes' Zehringen	Oct. 2	16	10.7	72.5	Yes.
474	....do	....do	R. Willard	Vilmorin's Improved	....do	23	7.1	61.5	Yes.
377	Charlevoix	Boyne	Van R. Nervoille	Kleinwanzlebener (Mrozinski)	Sept. 30	27	8.6	68.7	Yes.
571	Gratiot	Sickels	A. L. Wight	Vilmorin's Improved	Oct. 15	14	12.3	78.2	No.
524	Iron	Iron River	J. S. Kinney		....do	29	11.9	78.7	Yes.
574	Isabella	Weidman	A. A. Smith	Vilmorin's Improved	....do	25	12.7	80.2	Yes.
912	Lapeer	Dryden	Wm. Dittman	....do	Nov. 9	30	10.7	79	Yes.
157	Lenawee	Ridgeway	C. S. Foote	Strandes' Zehringen	Sept. 11	15	9.7	72.3	Yes.
249	....do	Tecumseh Township	D. T. Hall	Vilmorin's Improved	....do	14	13.2	79.4	Yes.
247	....do	Clinton Township	D. R. Gibson	Kleinwanzlebener (Dippe)	....do	10	10.6	75.2	Yes.
248	....do	Tecumseh Township	D. T. Hall	....do	....do	12	12.8	81.3	Yes.
432	....do	Clinton Township	D. R. Gibson	....do	Oct. 2	12	10	69.5	Yes.
454	....do	Tecumseh Township	D. T. Hall	....do	Oct. 3	31	10.6	71.3	Yes.
523	....do	Rollin	G. W. Belcher	Kleinwanzlebener	Oct. 2	32	6.9	63.4	Yes.
700	....do	Ridgeway	C. S. Foote	Strandes' Zehringen	Oct. 23	19	12.1	79.4	Yes.
628	....do	Clinton	D. R. Gibson	Kleinwanzlebener	....do	14	11.6	76.7	Yes.
629	....do	Blissfield	H. G. Clark	....do	Oct. 22	12	12.8	80.9	Yes.
747	....do	Palmyra	C. P. Palmer	....do	Oct. 27	18	12.2	81	No.
740	....do	....do	....do	Vilmorin's Improved	....do	22	11	75.8	No.
786	....do	Blissfield	W. H. Colyer	....do	Oct. 19	9	9.1	71.2	No.
787	....do	....do	....do	....do	Oct. 17	18	9.4	69.7	No.
864	....do	Britton	G. W. Smith	....do	Oct. 23	24	12.5	80	No.
893	....do	Palmyra	G. P. Palmer	Strandes' Zehringen	Nov. 14	17	11.2	71.7	No.
902	....do	....do	....do	Kleinwanzlebener	....do	9	12.3	78.7	No.
611	Macomb	Mount Vernon	C. L. Lockwood		Oct. 20	54	8.1	62.9	
816	Manistee	Pierport	G. F. Beaver	Vilmorin's Improved	Oct. 30	16	13	83	No.
879	Mecosta	Rodney	W. F. Zehnzen	Kleinwanzlebener	Nov. 6	20	10.1	70.2	Yes.
881	....do	Titus	E. Scheibe	Vilmorin's Improved	Nov. 9	50	12.3	80.1	Yes.
1	Monroe	Dundee	D. E. Martin	....do	July 30	25	8.2	71.7	Yes.
2	....do	....do	C. V. Paul	Strandes' Zehringen	....do	5	8.6	.....	Yes.
3	....do	....do	....do	Vilmorin's Improved	....do	7	8	75.7	Yes.
4	....do	....do	H. C. Schultz	Kleinwanzlebener (Dippe)	....do	4	9.4	.....	Yes.
5	....do	....do	....do	Strandes' Zehringen	....do	5	8.6	.....	Yes.
6	....do	....do	....do	Vilmorin's Improved	....do	4	9.5	.....	Yes.
7	....do	....do	G. W. Toburen	Kleinwanzlebener (Dippe)	....do	8	10.8	77	Yes.
8	....do	....do	....do	Strandes' Zehringen	....do	6	11.5	.....	Yes.
9	....do	....do	J. Boldt	Vilmorin's Improved	....do	8	9	72	Yes.
10	....do	....do	....do	Kleinwanzlebener (Dippe)	....do	9	9.2	71.3	
11	....do	....do	H. P. Morse	....do	....do	6	8.3	.....	Yes.
12	....do	....do	I. Lloyd	....do	....do	10	7.4	65.7	Yes.
13	....do	....do	J. F. Koepke	Strandes' Zehringen	July 28	13	7.5	62.7	Yes.

Results of analyses of sugar beets in the chemical laboratory of the Department of Agriculture during the year 1900, by States—Continued.

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Serial number.	State or Territory and county.	Post-office.	Experimenter.	Variety.	When harvested.	Average weight.	Sugar in the beet.	Purity coefficient.	Was season favorable?
	MICHIGAN—continued.					*Ounces.*	*Per cent.*		
14	Monroe □	Dundee	C. Happy	Vilmorin's Improved	July 30	10	9	69.9	Yes.
15	do	do	do	Kleinwanzlebener (Dippe)	do	14	9.1	72.2	Yes.
16	do	do	H. Jasper	do	do	8	8.7	76.3	
17	do	do	do	Vilmorin's Improved	do	8	7.5	65.4	Yes.
18	do	do	do	Vilmorin's French Very Rich	do	14	7.8	65.6	Yes.
19	do	do	do	Kleinwanzlebener (Dippe)	do	6	11.5	.....	Yes.
20	do	do	do	Vilmorin's Improved	do	6	10.9	.....	Yes.
21	do	do	E. Kent	do	do	8	10.7	76.4	Yes.
22	do	do	do	Vilmorin's French Very Rich	July 31	13	9.8	71.5	Yes.
23	do	do	do	Kleinwanzlebener (Dippe)	do	9	10	74.1	
24	do	do	N. Jasper	do	Aug. 21	13	11.9	80.2	Yes.
25	do	do	E. Kent	do	do	8	12.7	79.8	Yes.
26	do	do	T. Brandt	do	do	8	10.4	75.7	Yes.
27	do	do	M. H. Kellogg	Vilmorin's Improved	do	8	10.6	82.3	Yes.
28	do	do	T. Brandt	do	do	3	9.4	73.3	Yes.
29	do	do	C. V. Paul	do	do	5	8.6	75.2	
30	do	do	T. Brandt	do	do	6	8.8	73.2	Yes.
31	do	do	do	Kleinwanzlebener (Dippe)	do	11	9.4	71.7	Yes.
32	do	do	do	do	do	8	9.4	71.2	Yes.
33	do	do	W. F. Lafler	do	do	11	8.9	72.9	Yes.
34	do	do	F. Hall	Vilmorin's Improved	do	18	9.2	74	Yes.
35	do	do	E. Kent	Vilmorin's French Very Rich	do	12	8.4	70.4	Yes.
36	do	do	C. V. Paul	Strandes' Zehringen	do	9	8.3	60.8	Yes.
37	do	do	T. Brandt	Vilmorin's Improved	do	9	9	77.9	Yes.
38	do	do	do	Kleinwanzlebener (Dippe)	do	6	10.1	75.7	Yes.
39	do	do	do	do	do	12	9.8	75.2	Yes.
40	do	do	do	Vilmorin's Improved	do	10	9	76	No.
41	do	do	H. M. Smith	Kleinwanzlebener (Dippe)	do	10	10.5	75.9	Yes.
42	do	do	T. Brandt	do	do	7	8.6	70.3	Yes.
43	do	do	Chas. Happy	do	do	12	10.5	75.9	Yes.
44	do	do	H. Jasper	Vilmorin's French Very Rich	do	11	9	74.6	Yes.
45	do	do	W. J. Kelley	Vilmorin's Improved	do	14	8.3	72	Yes.
46	do	do	W. F. Crowe	Kleinwanzlebener (Dippe)	do	8	11.5	76.1	Yes.
47	do	do	H. Jasper	Vilmorin's French Very Rich	do	16	11.2	74.2	Yes.
48	do	do	T. Brandt	Kleinwanzlebener (Dippe)	do	5	10.2	74.3	Yes.
49	do	do	do	Schreiber's Elite	Aug. 24	8	8.9	73.4	Yes.
50	do	do	W. F. Crowe	Kleinwanzlebener (Dippe)	Aug. 21	6	9.6	73.7	No.
51	do	do	H. Jasper	Vilmorin's Improved	do	9	9.5	74.1	No.

52	do	do	T. Brandt	Knauer's Mangold	do	13	8.1	62.9	Yes.
53	do	do	do	Vilmorin's French Very Rich	do	5	8.2	67.7	Yes.
54	do	do	H. Jasper	Vilmorin's Improved	do	13	12.1	77.5	Yes.
55	do	do	T. Brandt	Kleinwanzlebener (Dippe)	do	10	10.6	75	Yes.
56	do	do	do	do	do	6	9	74.8	Yes.
57	do	do	H. Jasper	do	do	8	10	74.5	Yes.
58	do	do	W. F. Crowe	do	do	9	10.9	76.7	Yes.
59	do	do	H. Jasper	do	do	15	10	77.8	Yes.
60	do	do	H. C. Rodd	Vilmorin's Improved	do	15	10.5	75.9	Yes.
61	do	do	N. J. Carney	Vilmorin's French Very Rich	do	11	8.2	70.5	No.
62	do	do	H. Jasper	Kleinwanzlebener (Dippe)	do	10	11.3	78.3	Yes.
63	do	do	do	Vilmorin's Improved	do	13	9.5	74.6	Yes.
64	do	do	N. J. Carney	Kleinwanzlebener (Dippe)	do	16	9.1	72.2	Yes.
65	do	do	do	Vilmorin's French Very Rich	do	20	10.6	75.5	Yes.
66	do	do	H. Jasper	Vilmorin's Improved	do	17	9.9	74.8	Yes.
67	do	do	J. Boldt	Kleinwanzlebener (Dippe)	do	16	10	77.8	Yes.
68	do	do	I. Lloyd	do	do	8	9	71.4	Yes.
69	do	do	W. F. Crowe	do	do	17	10.6	76.2	Yes.
71	do	do	E. C. Post		Aug. 10	15	10.4	74.2	
72	do	do	do		Aug. 27	11	12.7	81.2	
73	do	do	Wm. Jasper	Kleinwanzlebener (Dippe)	Aug. 21	18	9.9	71.3	Yes.
94	do	do	D. T. Hall	Vilmorin's Improved	do	16	9.1	70.1	Yes.
95	do	do	E. C. Post		do	14	8	66.1	Yes.
96	do	do	N. L. Sage	Kleinwanzlebener (Dippe)	do	13	9.1	71.1	Yes.
97	do	do	W. F. Brandt	Vilmorin's French Very Rich	do	7	9.7	70.8	Yes.
98	do	do	W. E. Knabush	Vilmorin's Improved	do	12	8.7	72.4	Yes.
99	do	do	J. F. Koptie	Strandes' Zehringen	do	17	10.8	73.5	Yes.
100	do	do	D. Scranton	Kleinwanzlebener (Dippe)	do	7	8	62.2	Yes.
101	do	do	C. Valuet	do	do	9	10.7	75.3	Yes.
102	do	do	A. Haysted	Vilmorin's Improved	do	8	7.6	67.2	Yes.
103	do	do	F. W. Wittkop	Kleinwanzlebener (Dippe)	do	8	10.7	75.3	Yes.
104	do	do	E. C. Post		do	11	8.7	73.6	Yes.
105	do	do	F. R. Smith	Kleinwanzlebener (Dippe)	do	6	9.4	73.9	Yes.
106	do	do	F. C. Banner	Strandes' Zehringen	do	7	9.4	71.2	Yes.
107	do	do	Wm. Johnson	Kleinwanzlebener (Dippe)	do	9	9.1	73.3	Yes.
108	do	do	J. Boldt	Vilmorin's Improved	do	6	9.7	73.9	Yes.
109	do	do	D. T. Hall	do	do	10	9.8	72	Yes.
110	do	do	C. Happy	do	do	11	11.2	80.3	Yes.
111	do	do	E. C. Post	Kleinwanzlebener (Dippe)	do	4	10.1	88.3	Yes.
112	do	do	J. Boldt	do	do	8	10.5	76.9	Yes.
113	do	do	N. L. Sage	Vilmorin's Improved	do	9	9.1	69.6	Yes.
114	do	do	C. Valuet	Vilmorin's French Very Rich	do	9	10.5	75.3	Yes.
115	do	do	C. Wittkop	Kleinwanzlebener (Dippe)	do	7	9.9	74.8	Yes.
116	do	do	F. Haysted	Strandes' Zehringen	do	12	10.6	76	Yes.
117	do	do	G. W. Toburen		do	12	10.8	80.3	Yes.
118	do	do	F. Meus	Strandes' Zehringen	do	8	9.8	75.8	Yes.
119	do	do	A. H. Schultz	do	do	7	9.7	71.3	Yes.
120	do	do	E. Austen	do	Aug. 27	15	11.2	79.7	Yes.
121	do	do	do	Kleinwanzlebener (Dippe)	do	17	9.4	75	Yes.
122	do	do	E. C. Post	Vilmorin's Improved	Aug. 31	9	10.6	81.2	Yes.
147	do	do	G. W. Miller	Kleinwanzlebener (Dippe)	Sept. 7	17	10.8	71.3	Yes.
149	do	do	E. Kent	Vilmorin's Improved	Sept. 11	15	12.4	78.3	Yes.

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Serial number.	State or Territory and county.	Post-office.	Experimenter.	Variety.	When harvested.	Average weight.	Sugar in the beet.	Purity coefficient.	Was season favorable?
	MICHIGAN—continued.					*Ounces.*	*Per cent.*		
150	Monroe ◺	Dundee	A. M. Collis	Kleinwanzlebener (Dippe)	Sept. 11	15	12.2	76.6	Yes.
151	do	do	E. Kent	Vilmorin's Improved	do	17	11.8	76.5	Yes.
152	do	do	Wm. Johnson	Kleinwanzlebener (Dippe)	do	22	12	75.9	Yes.
153	do	do	H. Jasper	Vilmorin's French Very Rich	do	8	13.3	79.1	Yes.
154	do	do	H. Vogelsong	Kleinwanzlebener (Dippe)	do	13	10	75	Yes.
155	do	do	F. W. Wittkop	do	do	7	11.9	81.2	Yes.
156	do	do	H. Jasper	Vilmorin's Improved	do	13	14.1	80.9	Yes.
158	do	do	do	do	do	8	10.1	70.2	Yes.
204	do	do	B. E. Bullock	Kleinwanzlebener (Dippe)	do	11	11.7	80.4	Yes.
206	do	do	D. A. Pelton	Vilmorin's Improved	do	9	10.5	75.9	Yes.
208	do	do	E. C. Post	do	do	10	9.9	74.8	Yes.
209	do	do	B. E. Bullock	Kleinwanzlebener (Dippe)	do	10	9.6	72.7	Yes.
210	do	do	N. J. Cornig	Vilmorin's French Very Rich	do	10	10.5	72.8	Yes.
211	do	do	F. C. Bamm	Strandes' Zehringen	do	12	11.6	79.7	Yes.
215	do	do	J. F. Koppe	do	do	16	12.5	77.6	Yes.
216	do	do	E. Auten	do	do	16	12.5	81	Yes.
217	do	do	Wm. Johnson	Kleinwanzlebener (Dippe)	do	13	11.8	78.5	Yes.
218	do	do	H. Vogelsong	do	do	9	11.9	78.2	Yes.
219	do	do	W. F. Crowe	do	do	8	12.6	77.3	Yes.
220	do	do	F. Winkleman	do	do	7	10.1	75.7	Yes.
221	do	do	W. F. Crowe	do	do	10	12.1	77.9	Yes.
222	do	do	do	Kleinwanzlebener	do	11	12.7	78.4	Yes.
223	do	do	F. Haysted	Strandes' Zehringen	do	21	12.5	78	Yes.
224	do	do	J. Boldt	Kleinwanzlebener (Dippe)	do	11	9.2	76.4	Yes.
225	do	do	B. C. Drew	do	do	13	8.1	67	Yes.
226	do	do	C. Happy	do	do	12	12.5	78	Yes.
227	do	do	T. D. Volker	Strandes' Zehringen	do	20	10	73.4	Yes.
228	do	do	H. Jasper	Kleinwanzlebener (Dippe)	do	13	9.8	71	Yes.
229	do	do	H. Vogelsong	do	Sept. 10	9	11.1	72.7	Yes.
230	do	do	G. W. Toburen	Strandes' Zehringen	Sept. 11	20	11.4	78.4	Yes.
231	do	do	N. L. Sage	Vilmorin's Improved	do	18	10.6	74.2	Yes.
232	do	do	C. V. Paul	Strandes' Zehringen	do	19	10.3	78.3	Yes.
233	do	do	W. F. Crowe	Kleinwanzlebener (Dippe)	do	11	11.7	78.4	Yes.
234	do	do	J. Boldt	Vilmorin's Improved	do	7	9	73.1	Yes.
235	do	do	G. W. Toburen	Kleinwanzlebener (Dippe)	do	19	11.8	78.5	Yes.
236	do	do	W. J. Kelley	do	do	16	10.6	79.4	Yes.
238	do	do	C. Happy	Vilmorin's Improved	do	17	13.4	85.5	Yes.
239	do	do	H. P. Seem	Strandes' Zehringen	do	6	13.3	83.3	Yes.

240	do	do	do	do	do	7	13	82.5	Yes.
172	do	do	B. E. Bullock	Vilmorin's Improved	do	10	11.8	78.5	Yes.
173	do	do	do	do	do	8	10.3	72	Yes.
174	do	do	H. C. Rodd	Kleinwanzlebener (Dippe)	do	13	10.3	73.3	Yes.
175	do	do	B. E. Bullock	do	do	10	11.7	75.5	Yes.
176	do	do	C. F. Barker	Strandes' Zehringen	do	8	11.3	75.4	
177	do	do	B. E. Bullock	Vilmorin's Improved	do	8	11.3	76.3	Yes.
178	do	do	A. Shaw	Kleinwanzlebener (Dippe)	do	8	11.8	76.5	Yes.
179	do	do	B. E. Bullock	Schrieber's Elite	do	11	11.8	76.1	Yes.
180	do	do	do	Kleinwanzlebener (Dippe)	do	14	11.3	72.6	Yes.
181	do	do	E. C. Post	Vilmorin's Improved	do	10	11.9	74.9	
182	do	do	H. C. Schultz	do	do	11	11.7	77.1	Yes.
183	do	do	F. L. Latler	Kleinwanzlebener (Dippe)	do	17	12.1	77.5	Yes.
184	do	do	Wm. Johnson	Vilmorin's Improved	do	13	12	77.3	Yes.
185	do	do	H. P. Morse	Kleinwanzlebener (Dippe)	do	14	11	75.8	Yes.
186	do	do	H. C. Rodd	Vilmorin's Improved	do	13	11.8	26.1	Yes.
187	do	do	B. E. Bullock	Kleinwanzlebener	do	20	11.6	77.7	Yes.
188	do	do	N. J. Corney	do	do	18	11.8	76.5	Yes.
190	do	do	B. E. Bullock	Vilmorin's Improved	do	6	11.2	76.6	Yes.
191	do	do	W. J. Kelley	do	do	14	9.5	70.4	Yes.
192	do	do	E. S. Haight	Kleinwanzlebener (Dippe)	do	9	8.4	62.9	Yes.
193	do	do	B. E. Bullock	do	do	13	10.9	75.2	Yes.
194	do	do	F. Lieb	do	do	10	9.7	72.3	Yes.
195	do	do	N. J. Corney	Vilmorin's Improved	do	18	13	80.1	Yes.
196	do	do	B. E. Bullock	Kleinwanzlebener (Dippe)	do	12	12.5	78.1	Yes.
197	do	do	do	Knauer's Mangold	do	12	12	77.3	Yes.
198	do	do	N. C. Schultz	Strandes' Zehringen	do	9	11.4	78.4	Yes.
199	do	do	B. E. Bullock	Kleinwanzlebener (Dippe)	do	9	10.2	72.8	Yes.
200	do	do	do	Kleinwanzlebener	do	11	12.5	75.8	Yes.
201	do	do	H. C. Schultz	Kleinwanzlebener (Dippe)	do	15	10.8	76.5	Yes.
202	do	do	H. Jasper	Vilmorin's Improved	do	14	14.5	78.5	Yes.
203	do	do	do	do	do	14	11.3	77.8	Yes.
90	do	do	I. Lloyd	Kleinwanzlebener (Dippe)	Aug. 21	18	7.7	64.3	Yes.
91	do	do	Wm. Johnson	do	do	8	9	69.8	Yes.
92	do	do	H. Wittkop	Strandes' Zehringen	do	11	8.7	71.3	Yes.
93	do	do	D. T. Hall	Kleinwanzlebener (Dippe)	do	11	10.2	74.8	Yes.
647	do	do	E. C. Post	Kleinwanzlebener	Oct. 22	7	14.5	.....	Yes.
638	do	do	B. E. Bullock	do	Oct. 23	19	10.5	75.3	Yes.
641	do	do	do	do	do	13	13.3	82.8	Yes.
643	do	do	do	do	do	15	14	81.2	Yes.
651	do	do	do	do	do	8	12	78.8	Yes.
660	do	do	do	Schreiber's Elite	do	13	12.1	77.5	Yes.
661	do	do	do	Kleinwanzlebener (Dippe)	do	12	12.5	79	Yes.
663	do	do	do	Vilmorin's French Very Rich	do	10	10.9	76.7	Yes.
664	do	do	do	do	do	11	10.9	76.2	Yes.
665	do	do	do	Kleinwanzlebener	do	11	14.3	83.3	Yes.
667	do	do	do	Vilmorin's Improved	do	9	13.3	82.3	Yes.
668	do	do	do	Kleinwanzlebener	do	11	13.8	82.8	Yes.
669	do	do	do	do	do	16	14	81.7	Yes.
672	do	do	do	Knauer's Mangold	do	14	11.5	77	Yes.
673	do	do	do	Kleinwanzlebener	do	16	13.2	80.8	Yes.
693	do	do	do	Vilmorin's Improved	do	9	12.2	81.5	Yes.

Results of analyses of sugar beets in the chemical laboratory of the Department of Agriculture during the year 1900, by States—Continued.

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Serial number.	State or Territory and county.	Post-office.	Experimenter.	Variety.	When harvested.	Average weight.	Sugar in the beet.	Purity coefficient.	Was season favorable?
	MICHIGAN—continued.					*Ounces.*	*Per cent.*		
690	Monroe ⌞□	Dundee	B. E. Bullock	Vilmorin's Improved	Oct. 23	13	12.6	81.1	Yes.
725	....do	Raisinville	C. Happy	Kleinwanzlebener	....do	11	13.7	86.2	Yes.
726	....do	....do	....do	Vilmorin's Improved	....do	13	11.8	82.1	Yes.
746	....do	Dundee	F. Haysted	Strandes' Zehringen	....do	18	13.9	81.6	Yes.
759	....do	....do	A. Haysted	Vilmorin's Improved	....do	9	10.9	77.2	Yes.
758	....do	....do	J. F. Koppa	Strandes' Zehringen	....do	17	14.8	83.9	Yes.
763	....do	....do	F. C. Bamm	....do	....do	12	11.9	80.2	Yes.
760	....do	....do	J. Boldt	Vilmorin's Improved	....do	4	10.3	.....	Yes.
160	....do	....do	E. Kent	Kleinwanzlebener (Dippe)	Sept. 11	14	13.9	82.9	Yes.
161	....do	....do	A. H. Schultz	Strandes' Zehringen	....do	9	13.4	81.5	Yes.
162	....do	....do	Wm. E. Knabush	Vilmorin's Improved	....do	26	10.5	79.1	
163	....do	....do	H. Jasper	....do	....do	12	12	74.1	Yes.
164	....do	....do	H. P. Seem	Strandes' Zehringen	....do	4	13.7	82.3	Yes.
165	....do	....do	H. Jasper	Vilmorin's Improved	....do	14	13.9	81.1	Yes.
166	....do	....do	C. V. Paul	....do	....do	16	10.6	77.2	Yes.
167	....do	....do	E. C. Post	Strandes' Zehringen	....do	22	11.2	75.2	Yes.
168	....do	....do	R. Willard	Vilmorin's Improved	....do	13	6.6	62.7	Yes.
169	....do	....do	H. Jasper	Kleinwanzlebener (Dippe)	....do	8	13.3	78.2	Yes.
171	....do	....do	P. J. Tingley	Vilmorin's Improved	....do	10	11.4	75.5	Yes.
241	....do	....do	E. Auten	Kleinwanzlebener (Dippe)	....do	15	13.2	79.9	Yes.
242	....do	....do	E. C. Post	....do	....do	14	10.2	74.3	Yes.
243	....do	....do	T. Hall	Vilmorin's Improved	....do	16	11.8	78	Yes.
244	....do	....do	C. Valnet	Vilmorin's French Very Rich	....do	25	12.1	80.8	Yes.
245	....do	....do	....do	Kleinwanzlebener (Dippe)	....do	24	11.9	77.1	Yes.
246	....do	....do	....do	....do	....do	19	12.5	78.6	Yes.
250	....do	....do	F. Meus	Strandes' Zehringen	....do	9	13.6	83.1	Yes.
251	....do	....do	E. Teachout	Kleinwanzlebener (Dippe)	....do	17	11.7	78.8	Yes.
252	....do	....do	D. E. Martin	Vilmorin's Improved	....do	16	11.1	77.9	Yes.
253	....do	....do	H. Jasper	Kleinwanzlebener (Dippe)	....do	9	17.7	86.1	Yes.
254	....do	....do	N. Allison	....do	....do	6	12.5	81.4	Yes.
255	....do	....do	E. C. Post	.....	Sept. 17	12	11.9	77.2	
271	....do	....do	G. S. Wakefield	Vilmorin's Improved	....do	41	10.3	77.1	Yes.
282	....do	....do	E. C. Post	Licht's Zuckerreichste	Sept. 18	6	12.5	.....	Yes.
283	....do	....do	....do	....do	....do	4	15.5	.....	Yes.
284	....do	....do	....do	....do	....do	9	18.1	84.1	Yes.
285	....do	....do	....do	....do	....do	10	16.5	83.2	Yes.
286	....do	....do	....do	....do	....do	8	15.7	80.1	Yes.
389	....do	....do	H. P. Morse	Kleinwanzlebener (Dippe)	Oct. 2	11	12.4	79.8	Yes.

388	do	do	H. Jasper	do	do	11	12.3			Yes.
387	do	do	do	do	do	13	12.4	76		
386	do	do	B. E. Bullock	do	do	16	12.1	77.5		Yes.
385	do	do	do	do	do	13	12.2	80		Yes.
384	do	do	do	do	do	12	11.4	76.4		Yes.
383	do	do	do	Vilmorin's Improved	do	12	12.3	79.2		Yes.
382	do	do	G. N. Miller	Kleinwanzlebener (Mroziuski)	do	14	12.1	79.9		Yes.
380	do	do	B. E. Bullock	Kleinwanzlebener (Dippe)	do	15	13.4	81.5		Yes.
379	do	do	J. Boldt	Vilmorin's Improved	do	5	10.6	77.8		Yes.
390	do	do	Van De Venter & Sons	Knauer's Mangold	do	31	8.2	62.7		Yes.
397	do	do	A. Shaw	Kleinwanzlebener (Dippe)	do	8	15.2	85.1		Yes.
396	do	do	William Johnson	do	do	14	13.9	80.7		Yes.
395	do	do	E. C. Post	do	do	9	11.2	76.1		Yes.
394	do	do	T. Volker	Strandes' Zehringen	do	11	14.5	79.7		Yes.
393	do	do	do	do	do	19	9.9	66.7		Yes.
399	do	do	E. C. Post	Vilmorin's French Very Rich	do	14	10.5	71.9		Yes.
400	do	do	S. P. Smith	Kleinwanzlebener (Dippe)	do	14	12.1	78.4		Yes.
401	do	do	A. H. Schultz	Strandes' Zehringen	do	12	14.4	85.8		Yes.
403	do	do	A. C. Schultz	Kleinwanzlebener	do	11	13.3	80.9		Yes.
402	do	do	C. Greenfield	Strandes' Zehringen	do	30	13	80.6		Yes.
401	do	do	B. C. Drew	Kleinwanzlebener	do	11	9.1	72.2		Yes.
405	do	do	F. W. Wittkop	do	do	10	12.9	81.4		Yes.
407	do	do	B. E. Bullock	Vilmorin's Improved	do	11	10.7	71.1		Yes.
408	do	Ida	H. P. Seem	Strandes' Zehringen	do	11	12.5	83.5		Yes.
409	do	Dundee	J. S. Koepka	do	do	23	13.6	87.2		Yes.
411	do	Ida	H. P. Seem	do	do	7	12.5	83.4		Yes.
420	do	do	do	do	do	6	12.5	81.5		Yes.
415	do	Dundee	I. Lloyd	Kleinwanzlebener	do	12	9.8	73		Yes.
417	do	do	W. Crowe	do	do	8	12.5	84.1		Yes.
443	do	do	E. Kent	Vilmorin's Improved	do	12	12.5	79		Yes.
430	do	do	do	Kleinwanzlebener	do	13	13.8	78.8		Yes.
426	do	do	do	Vilmorin's French Very Rich	do	14	14	85		Yes.
464	do	do	B. E. Bullock	do	do	13	11.7	76		Yes.
463	do	do	do	Kleinwanzlebener	do	7	11.4	76.9		Yes.
460	do	do	do	Vilmorin's French Very Rich	do	10	11.9	78.2		Yes.
458	do	do	do	Schreiber's Elite	do	9	11.4	75.5		Yes.
456	do	do	do	Kleinwanzlebener	do	8	11	74.8		Yes.
447	do	do	do	do	do	18	10.8	77		Yes.
466	do	do	do	Knauer's Mangold	do	13	11.4	77.4		Yes.
424	do	do	do	Kleinwanzlebener	do	13	12.5	78.6		Yes.
431	do	do	do	do	do	11	13.8	81.5		Yes.
453	do	do	do	Vilmorin's Improved	do	16	11	74.4		Yes.
498	do	do	H. C. Rodd	Kleinwanzlebener	do	11	12.8	77.2		Yes.
499	do	do	W. F. Layler	do	do	12	13.5	82.1		Yes.
440	do	do	C. M. Glasgow	Strandes' Zehringen	do	9	11.6	77.2		Yes.
457	do	do	N. J. Corney	Kleinwanzlebener	do	15	12.9	81.9		Yes.
446	do	do	do	Vilmorin's French Very Rich	do	18	11.8	78.5		Yes.
421	do	do	F. Meus	Strandes' Zehringen	do	13	12.8	79		Yes.
450	do	do	J. Boldt	Kleinwanzlebener	do	11	8.8	71.6		Yes.
422	do	do	N. C. Schultz	Vilmorin's Improved	do	9	13	82		Yes.
437	do	do	H. C. Schultz	Strandes' Zehringen	do	8	13	82		Yes.
448	do	do	A. M. Glasgow	Kleinwanzlebener	do	13	10.5	77.5		Yes.

Results of analyses of sugar beets in the chemical laboratory of the Department of Agriculture during the year 1900, by States—Continued.

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Serial number.	State or Territory and county.	Post-office.	Experimenter.	Variety.	When harvested.	Average weight.	Sugar in the beet.	Purity coefficient.	Was season favorable?
	MICHIGAN—continued.					*Ounces.*	*Per cent.*		
451	Monroe □	Dundee	T. Hall	Vilmorin's Improved	Oct. 2	15	12	75	Yes.
496	do	do	G. W. Toburen	Kleinwanzlebener	do	12	12.7	81.7	Yes.
'94	do	do	C. V. Paul	Vilmorin's Improved	do	9	10.4	74.6	Yes.
4.5	do	do	E. C. Post	Kleinwanzlebener	do	14	9.4	71.2	Yes.
490	do	do	M. H. Kellogg		do	17	10.9	78.8	Yes.
485	do	do	C. Schroder	Kleinwanzlebener	Oct. 3	12	12.1	76	Yes.
482	do	do	H. C. Rodd	Vilmorin's Improved	Oct. 2	9	11.8	76.1	Yes.
467	do	do	D. E. Martin	do	do	26	9.2	68.8	Yes.
465	do	do	H. Jasper	do	do	12	13.1	78	Yes.
462	do	do	F. Lieb	Kleinwanzlebener	do	8	8.9	80.3	Yes.
455	do	do	D. T. Hall	Vilmorin's Improved	Oct. 3	31	10.4	73.2	Yes.
436	do	do	N. L. Sage	Kleinwanzlebener	Oct. 2	15	11.4	75	Yes.
459	do	do	W. F. Crowe	do	do	9	10.2	75.9	Yes.
445	do	do	do	do	do	11	12.8	79.9	Yes.
468	do	do	do	do	do	9	12.5	78.6	Yes.
476	do	do	A. M. Smith	do	Oct. 3	15	11.4	77.4	Yes.
470	do	Raisinville	C. Happy	Vilmorin's Improved	Oct. 2	15	12.2	77.6	Yes.
469	do	do	do	Kleinwanzlebener	do	13	13.6	83.1	Yes.
481	do	do	C. L. Rehburg	Strandes' Zehringen	do	28	9.7	69.4	Yes.
501	do	Dundee	C. V. Paul	do	Oct. 5	9	10.2	77.5	Yes.
506	do	do	G. W. Toburen	do	Oct. 2	19	11.6	78.2	Yes.
650	do	Raisinville	E. Teachout	Kleinwanzlebener (Dippe)	Oct. 22	27	7.9	52.5	Yes.
682	do	London	N. Allison	do	Oct. 23	6	11.7	80.9	Yes.
699	do	Dundee	D. E. Martin	Vilmorin's Improved	do	16	11	74.8	Yes.
649	do	do	E. Teachout	Kleinwanzlebener	do	23	11.7	78.4	Yes.
692	do	do	F. Lieb	do	do	9	10	78.4	Yes.
761	do	do	J. Boldt	do	do	6	8.8	75	Yes.
763	do	do	C. Wittkop	do	do	5	11.4	80.5	Yes.
765	do	do	do	do	do	5	13.5	85	Yes.
754	do	do	W. F. Crowe	do	do	7	12.2	82.1	Yes.
756	do	do	do	do	do	8	11.1	79.6	Yes.
764	do	do	do	do	do	7	11.9	80.7	Yes.
767	do	do	do	do	do	6	12.3	83.2	Yes.
752	do	Exeter	W. C. Richards	do	do	15	12.4	78.3	Yes.
74	do	do	C. Voluet	Vilmorin's Improved	Aug. 21	15	10.5	76.9	Yes.
75	do	do	D. E. Martin	do	do	15	10.6	76.5	Yes.
76	do	do	N. J. Corney	Kleinwanzlebener (Dippe)	do	5	8	67.2	Yes.
77	do	do	E. C. Post	do	do	7	10.4	72.2	Yes.

78	....do	....do	J. Hilton	Vilmorin's Improved	....do	10	6.5	68	Yes.
79	....do	....do	E. C. Post		Aug. 27	15	9.2	70.8	Yes.
80	....do	....do	E. Teachout	Kleinwanzlebener (Dippe)	Aug. 21	12	8.5	71.7	
81	....do	....do	D. Scranton	Vilmorin's Improved	....do	7	8	68.3	Yes.
82	....do	....do	E. C. Post	Kleinwanzlebener (Dippe)	....do	12	6.6	65.7	Yes
83	....do	....do	H. P. Morse	....do	Aug. 20	8	9.1	74.1	Yes.
84	....do	....do	H. Vogelsang	....do	Aug. 21	6	7.6	67.2	Yes.
85	....do	....do	Van De Venter & Son	Knauer's Mangold	....do	9	7.9	66.9	
86	....do	....do	H. P. Seem	Strandes' Zehringen	....do	10	8.8	78.1	Yes.
87	....do	....do	G. W. Toburen	Kleinwanzlebener (Dippe)	....do	11	10.3	76.6	Yes.
88	....do	....do	H. C. Rodd	....do	....do	15	9.8	72.5	Yes.
89	....do	....do	A. Shaw	....do	....do	8	10.6	78.3	Yes.
689	....do	....do	T. Hall		Oct. 23	11	14	82.1	Yes.
640	....do	....do	H. C. Schultz	Vilmorin's Improved	....do	12	12.9	82.9	Yes.
675	....do	....do	....do	Kleinwanzlebener	....do	13	12.5	82.9	Yes.
688	....do	....do	....do	Strandes' Zehringen	....do	7	12.8	84.9	Yes.
666	....do	....do	E. Kent	Vilmorin's French Very Rich	....do	11	14.7	83.8	Yes.
686	....do	....do	....do	Kleinwanzlebener	....do	9	14.9	83.1	Yes.
679	....do	....do	N. J. Corney	Vilmorin's French Very Rich	....do	20	11.7	80.9	Yes.
671	....do	....do	C. V. Paul	Strandes' Zehringen	....do	6	13.2	81.8	Yes.
655	....do	....do	....do	Vilmorin's Improved	....do	10	14.1	72.2	Yes.
656	....do	....do	H. P. Morse	Kleinwanzlebener	....do	8	12.2	81.5	Yes.
644	....do	....do	Van De Venter & Son	Knauer's Mangold	....do	16	11.6	78.7	Yes.
636	....do	....do	H. C. Rodd	Kleinwanzlebener	....do	16	12.5	80.5	Yes.
635	....do	....do	E. Anten	Strandes' Zehringen	....do	13	15.8	87.1	Yes
633	....do	....do	H. C. Rodd	Vilmorin's Improved	....do	18	10.8	76	Yes.
632	....do	....do	E. Kent	....do	....do	9	14.1	81.1	Yes.
631	....do	....do	G. W. Miller	Kleinwanzlebener	....do	13	10	77.8	Yes.
634	....do	....do	E. C. Post	....do	Oct. 22	6	15.9	.....	Yes.
637	....do	....do	....do	....do	....do	12	15.2	.....	Yes.
642	....do	....do	....do	....do	....do	12	13.8	.....	Yes.
709	....do	Raisinville	W. J. Kelley	Vilmorin's Improved	Oct. 23	13	10.8	77.6	Yes.
707	....do	Dundee	G. W. Toburen	Kleinwanzlebener	....do	13	14.1	79.1	Yes.
706	....do	....do	C. F. Barker	Strandes' Zehringen	....do	18	14.1	80.7	Yes.
705	....do	....do	T. D. Volker	....do	....do	15	12.8	80.9	Yes.
704	....do	....do	N. J. Corney	Vilmorin's French Very Rich	....do	20	10.9	77.2	Yes.
703	....do	....do	J. Hand	Vilmorin's Improved	....do	19	9.8	75.2	Yes.
702	....do	....do	N. J. Corney	Kleinwanzlebener	....do	13	15.7	81.2	Yes.
712	....do	....do	T. D. Volker	Strandes' Zehringen	....do	15	10.3	74	Yes.
713	....do	....do	G. W. Toburen	....do	....do	21	10.3	74	Yes.
715	....do	....do	I. Lloyd	Kleinwanzlebener	....do	8	10.3	78.3	Yes.
718	....do	....do	W. J. Kelley	....do	....do	11	12.1	80.9	Yes.
899	....do	....do	E. C. Post	....do	Nov. 15	13	15.1	.....	Yes.
898	....do	....do	....do	....do	....do	10	15.5	.....	Yes.
897	....do	....do	....do	....do	....do	6	11	.....	Yes.
896	....do	....do	....do	....do	....do	12	15	.....	Yes.
895	....do	....do	....do	....do	....do	14	12.1	.....	Yes.
839	....do	....do	N. J. Corney	Vilmorin's French Very Rich	Nov. 6	61	10.6	77.1	Yes.
900	....do	Monroe	G. S. Wakefield	Vilmorin's Improved	Nov. 13	30	11.8	76.5	Yes.
926	....do	....do	E. Kent	....do	Nov. 20	10	12.7	82.7	Yes.
928	....do	....do	B. E. Bullock	Vilmorin's French Very Rich	....do	7	13.9	85.9	Yes.
930	....do	....do	E. Kent	Kleinwanzlebener	....do	7	15.7	90.7	Yes.

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	MICHIGAN—continued.					*Ounces.*	*Per cent.*		
922	Monroe□	Monroe	B. E. Bullock	Vilmorin's Improved	Nov. 20	9	14.4	85.8	Yes.
606	Montcalm □	Edmore	C. W. Curtis	do	Oct. 19	15	11.5	78.5	Yes.
812	do	do	do	do	Nov. 2	18	12.7	81.7	Yes.
936	do	Butternut	E. W. Johnson	do	Nov. 19	33	10.1	73.1	Yes.
814	Oakland □	Davisburg	A. L. Gregory	do	Nov. 1	37	10	75.6	Yes.
304	St. Clair □-	Marine City	C. O. Smith	Kleinwanzlebener (Dippe)	Sept. 20	73	9.8	.....	Yes.
577	do	Peters	V. E. Boehmer		Oct. 13	26	13.3	78.7	Yes.
576	do	do	do		Oct. 15	63	10.9	69.2	Yes.
883	do	Brockway	Wm. Mason	Kleinwanzlebener	Nov. 19	18	14.6	81.9	Yes.
595	St. Joseph □	Mendon	C. Mumby		Oct. 20	26	12.6	78.7	Yes.
517	do	do	S. H. Alvord	Kleinwanzlebener	Oct. 5	12	12.4	82.8	Yes.
519	do	do	do	Strandes' Zehringen	do	13	10.8	79.7	Yes.
514	do	do	do	Vilmorin's Improved	do	12	8.4	72.1	Yes.
544	do	do	do	Kleinwanzlebener	do	8	11.1	78	Yes.
729	do	do	J. Mumby		Oct. 20	24	15	83.6	Yes.
143	Tuscola □-	Ellington	N. Emmons	Vilmorin's Improved	Sept. 5	20	9.6	76.5	Yes.
310	do	Caro	E. Reynolds	do	Sept. 20	15	11.7	76	Yes.
472	do	do	S. F. Mercer	do	Oct. 6	16	12.6	75.6	Yes.
604	do	do	J. Williams	Kleinwanzlebener	Oct. 19	61	10	74.5	Yes.
691	do	Ellington	C. Wickware	do	Oct. 21	15	13	80.1	Yes.
791	do	Caro	E. Reynolds	Vilmorin's Improved	Oct. 29	25	13.4	82.9	Yes.
905	do	do	J. G. Meiller	Kleinwanzlebener	Nov. 13	24	14.4	86.4	Yes.
280	Van Buren □	Bangor	M. W. Hyenga	Vilmorin's Improved	Sept. 17	37	8.9	74.6	Yes.
279	do	do	do	Kleinwanzlebener (Dippe)	do	26	11.3	79.4	Yes.
159	Washtenaw □	Pittsfield	J. Hentzman	Strandes' Zehringen	Sept. 11	32	9.1	75.6	Yes.
365	do	do	do	do	Oct. 2	32	10.2	71.3	
410	do	Milan	P. J. Tingbey	Vilmorin's Improved	do	17	11.9	73.1	Yes.
412	do	do	Wm. Johnson	do	do	17	12.2	75.7	Yes.
419	do	do	E. Auten	Strandes' Zehringen	do	18	12	74.6	Yes.
478	do	do	A. M Collis	Vilmorin's Improved	do	18	11.7	74.6	Yes.
461	do	do	Wm. Johnson	Kleinwanzlebener	do	13	12.2	81.5	Yes.
452	do	do	H. Jasper	Vilmorin's Improved	do	9	10.7	74.9	Yes.
449	do	do	do	Kleinwanzlebener	do	12	11	75.8	Yes.
444	do	do	do	Vilmorin's Improved	do	13	11.3	78.8	Yes.
442	do	do	do	Kleinwanzlebener	do	10	13.8	79.7	Yes.
441	do	do	do		do	12	11.1	80.7	Yes.
439	do	do	do	Vilmorin's Improved	do	13	12.1	79.8	Yes.
438	do	do	E. E. Spink	Kleinwanzlebener	Oct. 3	4	9	.....	Yes.

431	do	do	S. P. Smith	do	Oct. 2	6	10.7	72.9	Yes.
427	do	do	E. Auten	do	do	14	13.2	81.8	Yes.
423	do	do	N. Allison	do	do	5	10.6	78.7	Yes.
695	do	do	H. Jasper	do	Oct. 23	12	13.5	84	Yes.
687	do	do	do	Vilmorin's Improved	do	12	12.6	83.6	Yes.
671	do	do	do	Vilmorin's French Very Rich	do	12	12	81.3	Yes.
694	do	do	E. Auten	Kleinwanzlebener	do	7	13.7	81.2	Yes.
670	do	do	H. Jasper	do	do	12	11.4	80	Yes.
662	do	do	do	Vilmorin's Improved	do	13	12.1	81.4	Yes.
659	do	do	do	Kleinwanzlebener	do	14	12.2	82.1	Yes.
658	do	do	do		do	15	12.3	79.2	Yes.
657	do	do	do	Vilmorin's Improved	do	13	12.5	79	Yes.
646	do	do	do	Vilmorin's French Very Rich	do	12	13.1	83.1	Yes.
639	do	do	do	Kleinwanzlebener	do	21	12.6	79.7	Yes.
731	do	do	C. Vathet		do	18	12.1	82.5	Yes.
745	do	do	do	Vilmorin's French Very Rich	do	13	12.2	78	Yes.
753	do	do	do	Vilmorin's Improved	do	17	13.2	81.8	Yes.
755	do	do	Wm. Johnson	Kleinwanzlebener	do	23	12.2	80.5	Yes.
766	do	do	do	do	do	17	12.7	80.7	Yes.
743	do	do	do	Vilmorin's Improved	do	20	11.3	81.3	Yes.
711	do	do	A. Shaw	Kleinwanzlebener	do	14	11.9	78.2	Yes.
925	do	do	H. Jasper	Vilmorin's French Very Rich	Nov. 20	12	10.1	74.1	Yes.
927	do	do	do	Vilmorin's Improved	do	15	13.5	86.6	Yes.
923	do	do	do	do	do	10	11.3	76.8	Yes.
931	do	do	do	Kleinwanzlebener	do	11	12.5	79.1	Yes.
932	do	do	do	do	do	9	14.1	86.9	Yes.
381	do	do	do	Vilmorin's French Very Rich	Oct. 2	12	12.1	77.9	Yes.
237	Wayne □	Brownstown Township.	H. M. Smith	Kleinwanzlebener (Dippe)	Sept. 11	13	11	83	Yes.
678	do	do	do		Oct. 23	18	13.8	82.8	Yes.
821	do	Rawsonville	A. L. Yeckley	Kleinwanzlebener	Nov. 2	70	10.6	76.2	Yes.
	State averages (178 samples).					11	11.3	76.7	
	MINNESOTA.								
112	Becker □	Osage	E. D. Sylvester	Strandes' Zehringen	Sept. 4	37	10.6	77.2	No.
263	Carver □	Victoria	G. Van Sloan	Kleinwanzlebener (Dippe)	Sept. 13	13	11.8	83.2	No.
265	do	do	do		Sept. 12	16	12.7	85.9	No.
376	do	do	J. Ruppel		Sept. 30	33	11.6	76.7	No.
268	Clay □	Hawley	W. Fountain		Sept. 13	11	9.8	75.8	No.
888	Jackson □	Lakefield	H. W. Wehl		Nov. 12	31	13.4	76.7	Yes.
721	Pope □	Lowry	J. Hrdlicka	Kleinwanzlebener (Mroziuski)	Oct. 24	48	9.4	67.8	No.
491	Renville □	Renville	K. Warner	Kleinwanzlebener	Oct. 3	53	9.6	73.2	No.
502	do	do	do	do	do	32	8.5	63.1	No.
558	Stearns □	St. Cloud	F. Mesenburg	do	Oct. 25	32	11.7	79.4	No.
	State averages (10 samples).					31	10.9	75.9	

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Serial number.	State or Territory and county.	Post-office.	Experimenter.	Variety.	When harvested.	Average weight.	Sugar in the beet.	Purity coefficient.	Was season favorable?
	MISSOURI.					*Ounces.*	*Per cent*		
128	Audrain □	Mexico	B. F. Shepherd	Vilmorin's Improved	Sept. 4	12	10.4	72.7	Yes.
256	Cass ←□	Strasburg	F. Long		Sept. 15	11	9	63.7	No.
264	Jefferson □→	Desoto	J. F. G. Herget	Vilmorin's Improved	Sept. 13	15	9.6	77.7	No.
258	do	do	do	do	do	16	8.4	68.2	No.
332	do	Pevely	F. Thomi	Kleinwanzlebener (Dippe)	Sept. 22	9	10.2	73.8	
968	Shelby □↗	Shelbina	J. S. Chandler		Nov. 14	6	6.6	57	No.
495	St. Louis City □→	St. Louis	R. L. Coleman	Kleinwanzlebener and Vilmorin.	Oct. 4	23	9.7	71.3	Yes.
500	Wayne □↘	Zeitonia	O. C. Lucy	Kleinwanzlebener	do	26	7	64.3	Yes.
503	do	do	do	do	do	17	5.4	56.4	Yes.
	State averages (9 samples).					15	8.5	67.2	
	MONTANA.								
278	Choteau □↑	Chinook	H. J. Badger	Vilmorin's Improved	Sept. 15	17	10.6	71.6	No.
338	Fergus □	Elso	H. Willis	Kleinwanzlebener (Dippe)	Sept. 20	57	10.8	75.5	No.
601	Flathead □↖	Kalispell	C. A. Lyneh		Oct. 15	33	13.1	71.9	No.
492	Madison □↙	Pageville	H. Utley		Oct. 2	44	6.9	60.3	Yes.
	State averages (4 samples).					38	10.4	69.8	
	NEBRASKA.								
587	Butler □→	Edholm	F. F. Loomis	Kleinwanzlebener	Oct. 17	25	11.8	76.5	No.
521	Douglas □→	Omaha	Omaha Loan and Trust	do	Oct. 11	26	11.8	80.5	Yes.
570	do	do	A. Williams	do	Oct. 15	35	9	69.9	Yes.
569	do	do	W. R. Aituran	do	do	36	8.4	67.2	Yes.
610	do	do	P. O'Dwyer	do	Oct. 20	33	8.1	62.9	No.
784	do	do	Omaha Loan and Trust	do	Oct. 31	34	11.2	78.7	Yes.
299	Dundy □	Ives	A. R. Thomas	Kleinwanzlebener (Dippe)	Sept. 17	35	7.5	66.4	No.
313	Gosper □↓	Elwood	J. H. Tockheck		Sept. 21	11	11.5	74.3	No.
315	do	Bertrand	W. W. Lewis	Vilmorin's Improved	Sept. 19	15	10.2	70.4	No.
821	Johnson □↘	Tecumseh	W. A. Clineburg		Nov. 7	24	10	72.9	Yes.
294	Valley □	Ord	W. A. Anderson	Kleinwanzlebener (Dippe)	Sept. 18	30	9.6	73.7	Yes.
	State averages (11 samples).					28	9.9	72.1	

	NEVADA.								
966	Washoe	Reno	Experiment Station	Vilmorin's Improved	Nov. 17	9	8.6	84.9	Yes.
960	.....do	.....do	.....do	Strandes' Zehringen	.....do	10	10.1	75.2	Yes.
961	.....do	.....do	.....do	Kleinwanzlebener	.....do	11	10.2	78.7	Yes.
	State averages (3 samples).					10	9.6	79.6	
	NEW HAMPSHIRE.								
579	Cheshire	Nelson	T. W. Barker	Vilmorin's Improved	Oct. 16	26	11.1	75.9	Yes.
822	.....do	.....do	.....do	.....do	Nov. 1	33	12.6	80.1	Yes.
621	Merrimack	Pittsfield	J. W. Sanborn		Oct. 24	21	9.5	71.9	No.
622	.....do	.....do	.....do		Oct. 17	27	10.2	73.3	No.
627	.....do	.....do	.....do		Oct. 24	23	12.6	77.1	Yes.
623	.....do	.....do	J. E. Leighton		Oct. 16	15	10	72.1	No.
624	.....do	.....do	W. H. White		.....do	23	11	73.4	No.
625	.....do	.....do	J. C. McIntosh		.....do	40	12.2	76.2	No.
626	.....do	.....do	Wm. E. Smith	Vilmorin's Improved	Oct. 17	46	11	73.9	No.
	State averages (9 samples).					29	11.1	74.9	
	NEW JERSEY.								
890	Cumberland	Rosenhayn	J. A. Williams	Kleinwanzlebener	Nov. 12	20	8.8	69.9	No.
903	Monmouth	Matawan	C. M. White	Vilmorin's Improved	Nov. 14	21	14	83.5	Yes.
	State averages (2 samples).					21	11.4	76.7	
	NEW MEXICO.								
826	San Juan	Jewett	E. Marceline	Vilmorin's Improved	Nov. 1	21	14.1	75.5	Yes.
833	.....do	.....do	.....do	.....do	.....do	25	14.8	80	Yes.
	Averages (2 samples).					23	14.5	77.8	
	NEW YORK.								
935	Cattaraugus	Great Valley	H. M. Beeles	Kleinwanzlebener (Mrozinski)	Nov. 19	9	13.8	84.3	No.
934	.....do	.....do	.....do	Kleinwanzlebener	.....do	21	13.	80.6	
944	.....do	.....do	.....do	Kleinwanzlebener (Mrozinski)	.....do	21	13	80.6	No.
943	.....do	.....do	.....do	Strandes' Zehringen	.....do	11	14.1	.....	
942	.....do	.....do	.....do	Vilmorin's Improved	.....do	17	13.2	78.1	No.
475	Chautauqua	Ellington	E. N. Kelly	.....do	Oct. 4	11	11.4	77.1	No.
547	.....do	Hamlet	Wm. E. Judd		Oct. 10	13	13.6	80.3	Yes.
789	.....do	Brocton	H. W. Pettit	Vilmorin's Improved	Oct. 30.	14	14.4	83.1	No.
829	.....do	Dunkirk	F. Werle	Kleinwanzlebener	Nov. 3	21	14.6	82.8	No.

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Serial number.	State or Territory and county.	Post-office.	Experimenter.	Variety.	When harvested.	Average weight.	Sugar in the beet.	Purity coefficient.	Was season favorable?
	NEW YORK—continued.					*Ounces.*	*Per cent.*		
985	Chautauqua □	Silvercreek	S. Morse	Kleinwanzlebener (Mrozinski No. 2).	Dec. 5	21	13.1	83.6	No.
986	do	do	W. H. Jacobs	Kleinwanzlebener	Dec. 6	38	13	83.5	No.
906	Genesee ⊐	Oakfield	B. W. Taylor	do	Nov. 13	14	15	83.6	Yes.
374	Jefferson ⊔	Theresa	E. H. Cooper		Oct. 1	11	11	77.3	
617	do	Natural Bridge	M. A. Samson		Oct. 22	31	12.6	77.8	No.
615	do	do	I. Arnold		do	19	12.3	82.7	No.
730	do	Watertown	G. L. Gardner	Vilmorin's Improved	Oct. 24	20	13.7	87.8	No.
719	do	do	P. O'Brien	do	do	18	13.5	84.5	No.
844	do	Alexandria Bay	J. F. Parker	Kleinwanzlebener	Nov. 5	34	11.9	76.3	No.
840	do	do	A. H. Houghton		Nov. 8	32	11.6	78.7	No.
852	do	do	R. Deans	New Danish	Nov. 7	29	9.7	70.3	No.
887	do	Threemile Bay	A. D. Fawre		Nov. 12	9	8.3	70.2	No.
909	do	Ellisburg	D. C. Woodruff	Vilmorin's Improved	Nov. 14	16	11.6	77.2	No.
613	Livingston ⊐	Dansville	A. Carey	do	Oct. 22	14	11.9	76.3	No.
894	Niagara ⊐	Lockport	E. Kamper		Nov. 13	53	10.5	75.9	No.
904	do	do	do		do	51	11.7	75.5	No.
531	Ontario ⊐	Naples	F. Greiner	Kleinwanzlebener	Oct. 9	12	13.9	81.1	No.
972	do	Geneva	New York Experiment Station.	Vilmorin's Improved	Dec. 10	18	14.4	80.3	
973	do	do	do	White Queen of the North	do	18	14.9	81.8	
976	do	do	do	do	do	17	15.1	80.7	
982	do	do	do	do	do	16	17.2	86.1	
979	do	do	do	do	do	16	17.3	85.4	
977	do	do	do	Kleinwanzlebener (Austrian Special).	do	17	15.2	83.8	
980	do	do	do	do	do	17	15.6	82.8	
983	do	do	do	do	do	16	15.3	84.3	
984	do	do	do	do	do	15	16.5	82.1	
974	do	do	do	do	do	17	14.4	82.2	
978	do	do	do	Vilmorin's Improved	do	19	16.2	83.7	
981	do	do	do	do	do	16	15.8	83.8	
975	do	do	do	do	do	19	14	80.3	
855	Oswego □	Fulton	W. S. Nelson	do	Nov. 5	17	13.1	72.2	No.
750	St. Lawrence ⊔	Tilden	Wm. Camal		Oct. 27	23	10.1	74.1	No.
901	Seneca □	Waterloo	N. L. Utzman	Vilmorin's Improved	Nov. 14	27	11	72.5	No.
497	Steuben □	South Canisteo	A. Wilson		Oct. 5	35	15	78.2	Yes.
578	do	Adrian	F. E. Hush	Vilmorin's Improved	Oct. 16	17	12.1	77.9	Yes.

708	....do	South Canisteo	A. Wilson		Oct. 25	33	11.4	73.2	Yes.
611	Suffolk	Port Jefferson	H. W. Miller	Kleinwanzlebener	Oct. 22	7	15.5		No.
583	Wayne	Macedon Center	Mrs. M. E. Pulver	....do	Oct. 20	28	12.6	78.7	No.
825	....do	Lyons	H. G. Hotchkiss	Vilmorin's Improved	Nov. 5	28	11.3	78.8	Yes.
834	....do	....do	....do	....do	....do	27	14.7	87.1	Yes.
303	Wyoming	Perry	Wm. Wickings		Sept. 22	52	10.6	75	No.
302	....do	....do	....do		....do	32	11.8	77.5	No.
	State averages (51 samples).					22	13.3	79.8	
	NORTH CAROLINA.								
618	Alleghany	Edwards Crossroads	H. M. Crouse	Kleinwanzlebener	Oct. 20	31	11.3	76.8	No.
820	....do	....do	....do	....do	Nov. 1	13	10.7	74.4	No.
226	Montgomery	Troy	W. A. Foreman	Kleinwanzlebener (Dippe)	Sept. 14	28	7.5	74	No.
723	Watauga	Virgil	F. N. Hardin	Kleinwanzlebener	Oct. 24	20	11.5	80.2	No.
	State averages (4 samples).					23	10.3	76.4	
	NORTH DAKOTA.								
607	Bottineau	Willow City	J. M. Lazier	Kleinwanzlebener	Oct. 16	11	12	73.3	No.
522	Dickey	Monango	C. G. Fait		Oct. 11	41	7.1	66.3	
308	Grand Forks	Larimore	J. Lunney		Sept. 20	17	8.9	68.6	Yes.
291	McHenry	Velva	W. A. McKern	Kleinwanzlebener (Dippe)	Sept. 18	19	10.6	73.5	No.
859	Rolette	St. John	F. A. Bourenssa	Kleinwanzlebener	Nov. 5	20	12.1	73.8	No.
	State averages (5 samples).					22	10.2	71.1	
	OHIO.								
272	Athens	Albany	H. Fisher	Russian	Sept. 20	27	7.6	67.2	No.
868	Carroll	Sherodsville	M. M. Belknap	Kleinwanzlebener	Nov. 8	63	9.3	69.5	No.
807	Clark	Enon	D. Baker	Vilmorin's Improved	Nov. 1	11	10.5	71.4	Yes.
808	Crawford	Galion	J. H. Cook	Kleinwanzlebener	Nov. 3	22	9.3	69	No.
992	Cuyahoga	Nottingham	F. A. Bowman		Dec. 15	32	14.1	85.1	
860	Franklin	Grove City	S. Taylor	Kleinwanzlebener	Nov. 12	11	9.5	69.1	No.
858	....do	....do	....do	Vilmorin's Improved	....do	13	11.5	77	No.
965	Henry	Deshler	J. C. Waltimere	Kleinwanzlebener	Nov. 10	17	11.6	79.7	Yes.
951	Huron	Norwalk	J. E. Hafner	....do	Nov. 21	17	12.1	77.4	No.
529	Knox	Mount Vernon	R. J. Ash	....do	Oct. 11	51	8.1	63.1	Yes.
510	....do	....do	....do	....do	....do	64	6.3	64	Yes.
886	....do	Howard	A. Blue		Nov. 11	12	11.9	80.2	No.
504	....do	Lock	Dr. J. W. Haines	Kleinwanzlebener	Oct. 6	11	8.1	70.4	No.
946	Lake	Little Mountain	A. M. Carver		Nov. 20	19	10.6	72.3	No.
548	Marion	Marion	S. Bolander	Kleinwanzlebener	Oct. 10	27	7.6	64	No.
367	Mercer	Coldwater	T. Tecamp	Kleinwanzlebener (Dippe)	Oct. 1	25	8.1	64.8	Yes.
313	....do	St. Peter	B. Grieshop	Vilmorin's Improved	Sept. 29	19	9.2	67.8	No.
312	....do	Coldwater	H. Saalman	Kleinwanzlebener (Dippe)	Sept. 27	26	12.5	75.8	Yes.

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Serial number.	State or Territory and county.	Post-office.	Experimenter.	Variety.	When harvested.	Average weight.	Sugar in the beet.	Purity coefficient.	Was season favorable?
	OHIO—continued.					*Ounces.*	*Per cent.*		
337	Mercer -□	Coldwater	Mrs. B. Isverding		Sept. 27	16	13.5	78.9	Yes.
596	....do	Macedon	N. Denny		Oct. 23	18	9.9	71.7	Yes.
542	....do	Coldwater	B. Gerdes	Switzberger	Oct. 13	42	10.2	72.3	Yes.
676	....do	Philothea	H. Steggemann	Kleinwanzlebener	Oct. 22	21	12.5	84	Yes.
677	....do	Macedon	William Curry		....do	28	7.5	68	Yes.
684	....do	Coldwater	H. Hageman	Kleinwanzlebener	Nov. 18	18	10.7		Yes.
727	....do	....do	C. Stuckenborg	Vilmorin's Improved	Oct. 24	23	9.8	72	Yes.
793	....do	Montezuma	H. B. Bennett		Oct. 29	11	11.1	70.9	Yes.
799	....do	Philothea	G. H. Ducr		Nov. 1	26	12.6	76.9	Yes.
802	....do	Carthagena	H. Dahlingher		Oct. 30	36	9.9	72.2	Yes.
884	....do	Coldwater	H. Vogel	Vilmorin's Improved	Nov. 12	14	12.2	74	Yes.
530	Montgomery -□	Dayton	R. P. Dickey, jr		Oct. 10	30	7.6	60.6	No.
731	....do	....do	J. Boughnecht	Kleinwanzlebener	Oct. 24	24	8.8	72.6	Yes.
333	Muskingum □	Fultonham	D. H. Coleman	Vilmorin's Improved	Sept. 24	12	9.9	72.7	No.
794	Ottawa ⊔	Oak Harbor	C. Vallin	....do	Oct. 30	37	11.5	72.4	No.
739	....do	....do	L. Seelig	....do	Oct. 27	16	11.8	75.2	Yes.
375	Paulding ⊐	Melrose	H. Harrell	....do	Oct. 1	14	10.6	73.2	No.
369	....do	Oakwood	A. R. Sattler		....do	30	9.8	75.7	Yes.
335	....do	Paulding	S. Brattam	Kleinwanzlebener	Sept. 25	25	9.7	73.9	No.
599	....do	Mondale	J. L. Anderson	Kleinwanzlebener (Dippe)	Oct. 20	23	10	75	Yes.
738	....do	....do	J. B. Renner	....do	Oct. 26	39	9.4	69.7	Yes.
963	....do	Payne	J. Bique		Nov. 24	43	8.9	68.6	No.
267	Putnam ⊐	Leipsic	J. Siefker		Sept. 15	23	11.2	78.1	
370	....do	Ottorville	Wm. Schlagbaum	Vilmorin's Improved	Sept. 28	34	9.2	65.9	Yes.
539	....do	Leipsic	C. W. Falk		Oct. 12	27	8.6	69.8	Yes.
645	....do	Fort Jennings	F. W. Helmkamp	Kleinwanzlebener	Oct. 22	35	11.6	84.7	No.
735	....do	Glandorf	H. Recker	....do	Oct. 21	19	8.4	67.2	Yes.
736	....do	....do	....do	....do	Oct. 26	14	9.5	69.4	Yes.
768	....do	Leipsic	G. A. Fike	....do	Oct. 27	23	12.1	77	Yes.
774	....do	Hector	A. J. Troyer	....do	Oct. 29	20	11	79.4	Yes.
273	Richland ⊔	Davis	J. W. McConkie	Vilmorin's Improved	Sept. 17	18	8.9	72.3	No.
796	Sandusky ⊔	Fremont	J. Rimelspach	Kleinwanzlebener	Nov. 1	27	13.6	81.3	Yes.
832	....do	....do	G. P. Hafford		Nov. 5	15	14.7	83.8	Yes.
827	....do	....do	A. H. Speller	Kleinwanzlebener	....do	22	11.4	77.4	No.
882	....do	....do	C. H. Depp	....do	Nov. 9	26	12.5	81.5	Yes.
949	....do	....do	J. Rimelspach	....do	Nov. 24	41	11.9	76.7	Yes.
605	Summit ⊏	Ira	C. O. Hale		Oct. 19	25	7.7	63.8	No.
797	Union □	Watkins	G. Kirby		Oct. 29	20	9.9	71.7	No.
865	Warren ⊐	Franklin	D. S. Parker	Kleinwanzlebener	Nov. 9	49	9.1	71.1	Yes.

751	Wayne	Koch	E. Amist	Strandes' Zehringen	Oct. 26	19	9.8	73.6	Yes.
772	do	Wooster	Prof. C. E. Thorn		Oct. 29	14	14.3	84	
329	Wood	Dumbridge	F. Rogers	Vilmorin's Improved	Sept. 24	54	7.2	63.8	Yes.
373	do	Sugar Ridge	F. Tietjen	do	Oct. 1	38	8.8	69.4	Yes.
507	do	do	J. D. Smith		Oct. 8	28	11.4	76.9	Yes.
795	do	do	do	Kleinwanzlebener	Nov. 29	22	12.6	77.4	Yes.
877	do	Custer	D. N. Howe		Nov. 10	33	10.5	72.4	No.
	State averages (64 samples).					26	10.3	73.1	
	OKLAHOMA.								
316	Custer	Butler	J. N. Klein		Sept. 12	25	11.6	70.1	
290	Kingfisher	Kingfisher	J. W. Best	Kleinwanzlebener (Dippe)	Sept. 18	29	10.5	69.1	No.
292	do	do	do	do	do	24	10.7	70.2	No.
749	Lincoln	Carney	Miss E. S. Arnold		Oct. 24	9	9.4		No.
	Averages (4 samples)					22	10.6	69.8	
	OREGON.								
776	Harney	Lawen	A. F. B. George	Vilmorin's Improved	Oct. 20	33	11.2	73.3	Yes.
488	Josephine	Williams	A. C. Shinn	Vilmorin's Improved	Sept. 27	27	10.6	78.3	No.
603	do	do	do	do	Oct. 13	26	10	74.5	No.
347	Linn	Crawfordsville	O. P. Goodall		Sept. 24	12	12.3	83.2	No.
597	do	do	do		Oct. 15	20	11.6	79.2	No.
528	Umatilla	Weston	R. B. Fream	Kleinwanzlebener	Oct. 7	19	17	87.3	Yes.
189	Union	Richland	F. Craig		Sept. 8	8	12.1	77	Yes.
212	do	do	do		do	11	10.5	75.9	Yes.
295	do	La Grande	W. L. Owsley	Kleinwanzlebener (Dippe)	Sept. 17	8	15.7	86	Yes.
398	do	Telocaset	E. Conlon	Vilmorin's Improved	Oct. 1	31	13.2	78.1	No.
307	Wallowa	Joseph	F. X. Musty	do	Sept. 19	18	11.7	75	No.
	State averages (11 samples).					19	12.4	78.9	
	PENNSYLVANIA.								
361	Chester	Loag	P. W. Nagle		Oct. 3	23	9.5	73.5	
798	Clarion	Kingsville	D. O. Ken		Oct. 24	18	12.7	75.7	Yes.
918	do	do	do		Nov. 12	14	13.7	85.2	No.
917	Cumberland	Carlisle	F. C. Bosler	Kleinwanzlebener	Nov. 19	13	10	74	No.
913	do	do	do	do	do	12	9.2	68.3	No.
788	Erie	Erie	D. Schlosser	Vilmorin's Improved	Nov. 1	18	13.2	82.2	No.
867	do	do	do	do	do	26	9.7	74.5	No.
778	Montgomery	Colmar	Mrs. N. Dates	do	Oct. 30	26	9.8	73.6	Yes.
924	do	Oaks	T. Highley		Nov. 21	29	11.2	79.2	Yes.
891	Philadelphia	Frankford	W. K. Brown	Vilmorin's Improved	Nov. 12	31	10.7	74.4	Yes.
371	York	Windsor	D. A. Heindel		Oct. 1	23	6.7	62.3	No.
	State averages (11 samples).					21	10.6	74.8	

Results of analyses of sugar beets in the chemical laboratory of the Department of Agriculture during the year 1900, by States—Continued.

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Serial number.	State or Territory and county.	Post-office.	Experimenter.	Variety.	When harvested.	Average weight.	Sugar in the beet.	Purity coefficient.	Was season favorable?
	SOUTH CAROLINA.					*Ounces.*	*Per cent.*		
260	Chester ⊔	Chester	A. Owens		Sept. 17	21	7.7	64.8	No.
213	Chesterfield ◸	Catarrh	Wm. Middleton		Sept. 5	22	9.7	72.9	No.
146	Lancaster ⊔	Van Wyck	J. M. Swett		do	44	7.8	70.7	No.
	State averages (3 samples).					29	8.4	69.5	
	SOUTH DAKOTA.								
512	Clay □	Vermilion	J. T. Olson		Oct. 8	25	9.6	72.7	Yes.
588	Deuel ◸	Clear Lake	A. J. Lockhart		Oct. 15	20	11.8	74.3	Yes.
842	Jerauld □	Parsons	L. G. Wilson	Kleinwanzlebener	Nov. 5	12	13.1	78	Yes.
680	Lincoln ◺	Worthing	E. W. Norton	Desprez	Oct. 20	11	8.1	69	No.
413	Lyman ⊓	Earling	Mrs. M. L. Armstrong	Kleinwanzlebener	Sept. 29	9	13.5	73.9	Yes.
314	Sanborn □	Forestburg	J. Salisbury		Sept. 25	13	12.1	77.5	Yes.
493	do	do	do		Oct. 2	27	8.2	64.1	Yes.
584	Spink □	Redfield	C. A. Anderson		Oct. 17	87	9.2	69.8	No.
586	do	do	do		do	58	8.8	65.9	No.
	State averages (9 samples).					29	10.5	71.7	
	TENNESSEE.								
293	Bedford □	Wartrace	W. S. Waite	Kleinwanzlebener (Dippe)	Sept. 18	15	5.4	54.8	No.
	State average (1 sample).					15	5.4	54.8	
	TEXAS.								
132	Comal □	New Braunfels	J. Lauv	Kleinwanzlebener (Dippe)	Aug. 29	26	3.8	33	Yes.
131	do	do	do	do	do	38	3.8	38.3	Yes.
301	do	Anhalt	A. Doeppenschmidt		Sept. 4	7	10.9	72.8	
317	do	New Braunfels	H. E. Pentsh	Kleinwanzlebener (Dippe)	Sept. 16	13	6.2	57.9	No.
322	do	Anhalt	G. Letsch	do	Sept. 21	32	9.5	82	No.
330	do	do	do	do	do	17	9.8	71.5	No.
331	do	Crane's Mill	R. Fustel	do	Sept. 27	7	8.7	63.9	Yes.
554	do	Solms	Wm. Hubertus		Oct. 2	50	8	61.7	Yes.

875	Eusthaud ⏀	Jewett	T. Hixon		Nov. 8	43	2	29.1	Yes.
555	Jack ⏀	Bryson	W. E. Bottom		Oct. 15	11	4.6	46.6	No.
737	....do	....do	....do		Oct. 23	35	5.2	38.5	No.
559	Llano □	Llano	S. P. Collier	Vilmorin's Improved	Oct. 9	11	7.6	61.1	Yes.
718	....do	....do	....do		Oct. 25	27	9.1	66.6	Yes.
355	Taylor ⏀	Guion	M. L. Holt		Sept. 24	15	7.1	62.5	No.
813	....do	....do	....do		Oct. 31	47	7.8	67.2	No.
	State averages (15 samples).					29	6.9	56.8	
	UTAH.								
861	Utah □	Payson	J. Amos		Nov. 1	11	12.9	.....	No.
841	....do	....do	....do		....do	16	15	83.2	No.
567	Wasatch □	Heber	J. Crook	Kleinwanzlebener	Oct. 18	13	16.7	83.1	Yes.
779	....do	....do	....do		Oct. 24	15	15.6	81.5	No.
261	Weber ⏀	Harrisville	D. Crowther	Kleinwanzlebener (Dippe)	Sept. 23	15	8.6	74.4	Yes.
	State averages (5 samples).					14	13.8	81.3	
	VERMONT.								
477	Bennington ⏀	Rupert	B. Harwood	Vilmorin's Improved	Oct. 3	9	11.1	78.1	Yes.
720	Orleans ⏀	Gloverton	W. F. Clark		Oct. 22	16	11.6	78.7	No.
863	Rutland ⏀	N. Clarendon	G. A. Squin		Nov. 6	19	13.3	81.9	No.
	State averages (3 samples).					15	12.1	79.7	
	VIRGINIA.								
516	Albemarle □	Charlottesville	W. C. Chamberlain	Kleinwanzlebener	Nov. 6	1	7.9	.....	No.
806	....do	....do	....do		Oct. 16	3	9.7	70.3	No.
845	Amelia □	Dutch	Wm. Haver	Vilmorin's Improved	Nov. 8	39	10.6	70.9	No.
189	Caroline □	Delos	J. B. Hicks		Oct. 9	17	7.3	73.3	No.
568	....do	Sparta	G. L. Haynes		Oct. 15	22	11.3	79.1	No.
562	....do	....do	....do		....do	18	10	71.9	No.
563	....do	Bowling Green	J. L. Jordan		Oct. 16	15	8.8	68.9	No.
685	....do	....do	W. H. Gravatt		Oct. 23	1	13	79.7	No.
954	....do	....do	W. B. Covington	Kleinwanzlebener	Nov. 20	11	10.1	70.8	No.
952	....do	Lent	S. B. Hearn		Nov. 28	25	10.3	74	No.
866	Culpeper ⏀	Jeffersonton	T. Heflin	Imperial	Nov. 5	31	11.8	76.5	No.
696	Fauquier ⏀	Midland	G. W. Armstrong	Kleinwanzlebener	Oct. 23	26	10	76.7	No.
681	....do	....do	....do	....do	....do	16	9.9	74.8	No.
947	Henrico □	Richmond	J. G. Fitzgerald		Nov. 24	31	8.8	68.9	No.
921	Lancaster □	Irvington	Mrs. A. I. Mussick	Vilmorin's Improved	Nov. 17	11	8.2	70.5	No.
941	....do	....do	....do	Kleinwanzlebener	Nov. 16	28	7.8	44.3	No.
518	Orange □	Lahore	T. S. Casey	....do	Oct. 9	15	10.6	78.3	Yes.
873	....do	Unionville	R. Waugh	Kleinwanzlebener (Mrozinski)	Nov. 10	35	9.8	75.7	Yes.
809	....do	....do	W. C. Newman	....do	Nov. 3	11	10.3	73.5	No.
835	....do	....do	Mrs. C. Stewart	....do	....do	28	7.1	61.5	No.

Results of analyses of sugar beets in the chemical laboratory of the Department of Agriculture during the year 1900, by States—Continued.

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Serial number.	State or Territory and county.	Post-office.	Experimenter.	Variety.	When harvested.	Average weight.	Sugar in the beet.	Purity coefficient.	Was season favorable?
	VIRGINIA—continued.					*Ounces.*	*Per cent.*		
473	Prince William ⊔	Manassas	G. W. Johnson		Oct. 5	18	9.5	75.2	No.
358	Spottsylvania □	Fredericksburg	S. B. Richardson		Oct. 1	9	8.9	73.4	No.
366	do	do	A. A. Canaday	Kleinwanzlebener (Dippe)	Oct. 3	8	10.1	75.7	No.
505	do	do	J. T. Coleman	do	Oct. 6	17	7.6	69.6	No.
785	do	do	do		Oct. 26	9	10.2	72.8	No.
744	do	do	A. Silver	Vilmorin's Improved	Oct. 27	9	9.7	73.4	No.
869	do	Leavells	W. T. Kennedy	Kleinwanzlebener	Nov. 3	14	10.5	71.4	No.
916	do	Fredericksburg	A. Silver		Nov. 17	12	10.5	74	No.
938	do	Leavells	W. F. Stephens		Nov. 10	11	10.5	74	No.
969	do	do	J. B. Jerrell	Kleinwanzlebener	Nov. 30	11	10.5	74.3	No.
564	do	Fredericksburg	J. H. Smith	do	Oct. 16	13	9.5	71.4	No.
572	do	do	J. A. Sullivan	Strandes' Zehringen	Oct. 15	12	10.4	78.4	No.
777	do	do	S. Granger	do	Oct. 30	14	9.7	74.5	No.
803	do	do	J. H. Brown	do	Nov. 2	8	7.2	67.3	No.
919	do	do	S. Granger	do	Nov. 16	11	10.3	74	No.
990	do	do	J. A. Sullivan	Kleinwanzlebener (Mrozinski)	Dec. 12	6	12.4	85	No.
989	do	do	do	do	do	29	12	80.8	No.
991	do	do	do	do	do	14	12.3	83.8	No.
549	Stafford ⊔	Leeland	J. E. Berry	do	Oct. 12	11	8.6	73.8	No.
509	do	Falmouth	C. J. Chartlers	Kleinwanzlebener	Oct. 9	17	8.6	79.1	No.
560	do	Leeland	O. Berry		Oct. 12	20	7.9	68	Yes.
537	do	Berea	Wm. Clark	Kleinwanzlebener	Oct. 11	10	11.4	82.8	No.
857	do	Leeland	J. E. Bowler	do	Nov. 8	15	12.2	77.1	No.
880	do	Stafford	G. W. Truslow	Strandes' Zehringen	Nov. 7	31	9	75.4	No.
920	do	Falmouth	C. J. Chartlers	Kleinwanzlebener	Nov. 19	18	11.8	78.5	No.
948	do	do	B. W. Irwin	do	Nov. 23	16	11.7	76.4	No.
967	do	Leeland	W. H. Gallahan	do	Nov. 27	14	11.5	79.1	No.
988	do	do	S. Graninger	Strandes' Zehringen	Dec. 12	72	11.1	79.1	No.
885	Wythe ⊐	Max Meadows	G. C. Black		Nov. 2	10	11.7	77.4	No.
	State averages (49 samples).					18	10	74.1	
	WASHINGTON.								
368	Thurston ⊏	Tenino	Mrs. S. A. Van Tine	Strandes' Zehringen	Sept. 29	22	15.2	87	No.
846	Yakima ⊓	Ahtanum	D. B. Greenwater	Kleinwanzlebener (Mrozinski)	Nov. 2	26	14.6	84.2	Yes.
	State averages (2 samples).					24	14.9	85.6	

	WEST VIRGINIA.								
520	Raleigh ♀	Egeria	A. J. Hatcher	Kleinwanzlebener	Oct. 6	5	10.2	.....	No.
630	....do	....do	....do	....do	Oct. 20	7	13	.....	No.
311	Wayne □	Round Bottom	J. Prichard		....do	13	7.5	62.7	Yes.
305	Wirt ♉	Lee	A. E. Black	Kleinwanzlebener (Dippe)	Oct. 18	1	12	.....	No.
	State averages (4 samples).					7	10.7	62.7	
	WISCONSIN.								
326	Adams □	Oxford	A. H. Flook	Kleinwanzlebener (Dippe)	Sept. 21	30	8.6	67.4	No.
350	....do	Spring Creek	R. H. Gleason	Vilmorin's Improved	Sept. 25	17	10.6	74.7	No.
300	Columbia □	Kilbourn	M. M. Hayes		Sept. 20	34	9.1	70.1	No.
594	....do	....do	....do		Oct. 19	49	9.7	67.6	No.
800	Crawford □	Retreat	A. A. James		....do	32	9.1	67.6	No.
127	Dane ♀	Madison	F. W. Woll	Vilmorin's Improved	Sept. 1	12	11.7	81.5	Yes.
124	....do	....do	....do	White Queen of the North	....do	13	12	81.8	Yes.
125	....do	....do	....do	Kleinwanzlebener (Austrian Special).	....do	12	12.2	83.7	Yes.
870	Dunn ♉	Connersville	D. J. Pickard	Kleinwanzlebener	Nov. 6	73	11.4	76.4	No.
769	Grant □	Platterville	M. L. Moses	Vilmorin's Improved	Oct. 25	26	11.9	77.7	Yes.
487	Juneau □	Mauston	J. E. Palmer	....do	Oct. 6	31	8.3	69.6	Yes.
534	Langlade ♂	Antigo	F. J. Kubiaczyk	Kleinwanzlebener	Oct. 11	14	10.6	72.7	Yes.
557	....do	....do	....do	Vilmorin's Improved	....do	19	10	72.4	Yes.
546	Milwaukee ♌	Milwaukee	P. J. Mackeldon	....do	....do	38	10	73.4	Yes.
480	Outagamie ♎	Appleton	A. Kloes		Oct. 6	45	8.6	65.9	Yes.
270	Sauk □	Delton	M. L. Reynolds	Vilmorin's Improved	Sept. 17	35	7.7	67.5	No.
354	....do	Baraboo	M. S. Jip	....do	Sept. 26	22	10.1	74.7	No.
843	Walworth ♌	Whitewater	J. B. Smith	....do	Nov. 6	30	8.9	71.2	No.
	State averages (18 samples).					30	10	73.1	
	WYOMING.								
429	Sheridan ♁	Dayton	R. A. Frazier	Vilmorin's Improved	Sept. 28	17	12.8	79.1	No.
414	....do	....do	....do		Oct. 1	23	11.2	77.6	No.
	State averages (2 samples).					20	13.5	78.5	

Remarks on Preceding Tables.

GENERAL.

The farmers in collaboration with the Division were requested in sending samples to give a statement in regard to the favorableness or unfavorableness of the season. These responses are entered in the last column of the tables. In noting these, it must be remembered that the answers are not based upon meteorological data collected in the usual way, but upon the general impressions which a farmer forms of a season in respect to crop growth.

ARKANSAS.

Only two samples were received from this State, both of which were of inferior quality.

CALIFORNIA.

Four samples showed beets with favorable sugar content, but somewhat inferior to the general standard of the State.

COLORADO.

Fifty-seven samples were received from this State. The average size of the beets was extremely satisfactory, namely, 25 ounces. The content of sugar was high, namely, 14.1 per cent, while the purity was slightly below the standard.

These data, taken in connection with the other reported data from Colorado, show that under irrigation in that State beets of the most favorable character for sugar making can be produced.

DISTRICT OF COLUMBIA.

The samples from the District of Columbia were all grown on the Department farm on the island below Long Bridge. The reports are made according to variety. Six varieties were grown and 13 samples of each variety analyzed, taken at different periods from September 19 to December 11. These beets show a rather remarkable uniformity in comparison during the whole period over which the investigations were continued. In every case the size of the beets was somewhat under the standard which would be favorable to a high percentage of sugar. The sugar content in each case was very low and also the purity coefficient.

CONNECTICUT.

Only one sample was received from Connecticut, and that was of inferior quality.

DELAWARE.

Only one sample was received from this State, which was of small size, but had a high content of sugar and high purity.

GEORGIA.

Only one sample was received from Georgia, and this sample was very small, but had an exceptionally high content of sugar and purity coefficient. The fact that such a beet as this can be grown in Georgia should not be accepted as an evidence of the general fitness of that State for beet-sugar production.

IDAHO.

Nineteen samples were received from Idaho. The beets were of large size with a favorable sugar content and a purity slightly below the standard. The remark made with reference to beets grown in Colorado is also applicable to those produced in Idaho.

ILLINOIS.

Sixteen samples were received from this State. The beets were above the average size. The content of sugar was phenomenally low, also the purity.

This deterioration of the beets from Illinois during the present season is difficult of explanation. In most cases the season is reported as favorable, and yet the beets were the poorest ever received from that locality.

INDIANA.

Fifteen samples were received from Indiana. The beets were of medium size, but the content of sugar was very low, as was also the purity coefficient. The remark just made in respect to Illinois applies with almost equal force to the results of the analyses of the Indiana beets during the present season.

INDIAN TERRITORY.

Three samples were received from this Territory. The beets were above the average size, and the content of sugar and purity were remarkably low.

IOWA.

Thirty-nine samples were received from Iowa. The samples were far above the average size, and the content of sugar and purity do not compare very favorably with previous results from that State.

KANSAS.

Twenty samples were received from Kansas. The beets were slightly above medium size, and the content of sugar and purity compare favorably with previous results from that State, though neither is satisfactory.

KENTUCKY.

Twelve samples were received from the State of Kentucky. The size of the beets was below medium, the content of sugar low, and purity very low.

MAINE.

Two samples were received from Maine. The beets were of medium size, but the content of sugar and purity were remarkably low for beets grown in that latitude.

MARYLAND.

One sample only was received from Maryland. It was below the average in size, with a low sugar content and low purity.

MASSACHUSETTS.

Two samples were received from Massachusetts. Both were very small in size, but the sugar content was high.

MICHIGAN.

Four hundred and seventy-eight samples were received during the year from the State of Michigan, of which Monroe County contributed the greatest number. The average size of the beets was somewhat below the medium. The content of sugar and the purity coefficient were remarkably low for a State which has heretofore given such favorable results.

MINNESOTA.

Ten samples were received from Minnesota. These were above the average size, and the content of sugar and purity were both low for the locality.

MISSOURI.

Nine samples were received from Missouri of average size, but with very low sugar content and purity coefficient.

MONTANA.

Four samples were received from this State. These beets were very much overgrown, and the sugar content and purity were correspondingly low.

NEBRASKA.

Eleven samples received from the State of Nebraska, representing beets of above the average size and with a low content of sugar and low purity.

NEVADA.

Three samples were received from Nevada. These beets were, in every respect, the poorest ever obtained from that locality, being below the average size, and having a remarkably low content of sugar and purity compared with the results previously obtained in this State.

NEW HAMPSHIRE.

Nine samples were received from New Hampshire. The beets were above the average in size, and the content of sugar and purity were not so high as would be expected from the locality.

NEW JERSEY.

Two samples were received from New Jersey. They were of average size, with a sugar content and purity below the normal for successful manufacture.

NEW MEXICO.

Two samples were received from this Territory, of a good size, high content of sugar, but a purity slightly below the standard.

NEW YORK.

Fifty-one samples were received from the State of New York. These beets were of good size, with a high content of sugar and a purity coefficient barely short of the standard.

NORTH CAROLINA.

Four samples were received from the State of North Carolina. These samples were of fair size and with a content of sugar and purity quite satisfactory for the locality.

NORTH DAKOTA.

Five samples were received from this State. These samples were of medium size, but rather a low content of sugar and a low purity for the locality.

OHIO.

Sixty-four samples were received from the State of Ohio. The beets were slightly above the average size. The content of sugar and purity were not high enough for successful manufacture.

OKLAHOMA.

Four samples were received from Oklahoma. These were of medium size, with a fair content of sugar and purity for the locality.

OREGON.

Eleven samples were received from Oregon. These samples were of medium size, with a favorable sugar content for successful manufacture and a purity only slightly below the standard

PENNSYLVANIA.

Eleven samples were received from this State. These samples were of medium size, but had rather a low content of sugar and purity for the locality.

SOUTH CAROLINA.

Three samples were received from South Carolina. They were above the average size, and had a sugar content and purity far below the normal.

SOUTH DAKOTA.

Nine samples were received from South Dakota. These beets were above the average size, and had a sugar content and purity below the normal for that locality.

TENNESSEE.

The only sample received from this State was one of fair quality.

TEXAS.

Fifteen samples were received from the State of Texas. The beets were above the average size, and had a very low content of sugar and purity.

UTAH.

Five samples were received from the State of Utah. They were below the average size, but showed a satisfactory content of sugar and purity for successful manufacture.

VERMONT.

Three samples were received from this State. They were slightly below the average size, but in content of sugar and in purity were just about at the minimum limit for successful manufacture.

VIRGINIA.

Forty-nine samples were received from the State of Virginia. These beets were of medium size, and showed a content of sugar and purity coefficient quite satisfactory for the locality.

WASHINGTON.

Seven samples were received from this State. They were slightly above the average size and showed a very high content of sugar and a very high purity coefficient.

WEST VIRGINIA.

Four samples were received from West Virginia. These samples were very small and gave a small content of sugar and a very low purity coefficient.

WISCONSIN.

Eighteen samples were received from the State of Wisconsin. They were considerably above the average size and showed a very low content of sugar and purity coefficient for the locality.

WYOMING.

Two samples were received from this State. These samples were of average size. They showed a satisfactory content of sugar and a purity coefficient slightly below the standard.

A general review of the data obtained during the year shows that the beets as a whole were of remarkably poor quality as compared with samples received in previous years. This poor quality of the beets was doubtless due partly to seasonal influences and partly to the lack of proper attention in growing the beets. It is not safe to generalize in particular cases, and therefore in any conclusions which may be drawn from these data the results of previous experiments should be considered. A fairer criterion for the capabilities of the States for beet-sugar production is obtained by a study of the following tables, which contain the averages from the different States and Territories for a period of four years.

Average Results for Four Years.

In the following table are brought together the average results of the analyses made in this laboratory during the years 1897, 1898, 1899, and 1900. From these a general average for the four years has been secured. Such a general average increases in value as an indicator as the number of analyses and the number of years covered increase. This table shows the number of samples analyzed, the average weight of the beets in ounces, their sugar content, and coefficient of purity. The general average is found by multiplying the data for each year by the number of samples for that year, taking the sum of the

products and dividing by the total number of samples for the four years:

Average results of analyses of sugar beets for years 1897–1900, inclusive, by States.

States.	Year.	Number of samples.	Average weight.	Sugar in the beet.	Purity coefficient.
			Ounces.	*Per cent.*	
Arkansas	1897	2	18	11.3	71.5
	1898	6	23	7.1	67.5
	1899	5	15	6	55.5
	1900	2	9	6.7	61.6
Average for the four years		15	18	7.2	63.2
California	1897	1	26	16.8	.....
	1898	4	25	14.6	80.2
	1899	1	11	13.9	82
	1900	4	13	12.9	78.9
Average for the four years		10	19	14.1	79.8
Colorado	1897	174	20	13.6	76.7
	1898	50	22	13.7	80.1
	1899	64	24	14.4	80.2
	1900	57	25	14.1	78.7
Average for the four years		345	22	13.8	78.2
Connecticut	1898	4	21	10.3	76.2
	1899	2	17	10.9	75.5
	1900	1	20	10	73.4
Average for the three years		7	20	10.4	75.6
Delaware	1898	1	14	11.3	78.8
	1899	2	24	12.5	81.4
	1900	1	15	10	75.6
Average for the three years		4	19	11.6	79.3
District of Columbia	1899	4	24	6.4	56.9
	1900	78	13.6	8.7	70
Average for the two years		82	14.1	8.6	69.4
Georgia	1898	4	47	5.8	64
	1899	10	14	11	75
	1900	1	10	14.2	86.6
Average for the three years		15	23	9.8	72.8
Idaho	1897	7	21	12.5	79.4
	1898	5	28	12	78.3
	1899	1	36	10.8	75
	1900	19	26	13.5	81.5
Average for the four years		32	26	13	80.3
Illinois	1897	32	17	13.1	75.5
	1898	38	20	10.2	75.2
	1899	25	25	10.6	72.6
	1900	16	27	8.3	65.2
Average for the four years		111	21	10.9	73.3
Indiana	1897	103	14	13.1	78.9
	1898	88	21	10.1	75.5
	1899	29	19	11.4	73.4
	1900	15	21	9.4	71.1
Average for the four years		235	18	11.5	76.5
Indian Territory (one year)	1900	3	29	7.9	66.2
Iowa	1897	130	18	13.3	73.7
	1898	147	25	11.4	76.1
	1899	67	24	10.9	72.1
	1900	39	33	9.5	70.7
Average for the four years		383	23	11.8	74

Average results of analyses of sugar beets for years 1897–1900, inclusive, by States—Cont'd.

States.	Year.	Number of samples.	Average weight.	Sugar in the beet.	Purity coefficient.
			Ounces.	*Per cent.*	
Kansas	1897	41	27	11.4	73.8
	1898	16	22	10.3	71.3
	1899	35	21	9.5	66
	1900	20	25	10.1	72.1
Average for the four years		112	24	10.4	70.7
Kentucky	1897	6	16	11.9	71.5
	1898	4	14	5.9	61.1
	1899	1	5	7.4	.....
	1900	12	13	8.5	64.8
Average for the four years		23	14	8.9	67
Louisiana (one year)	1900	1	10	16.2	84.2
Maine (one year)	1900	2	19	8.1	67.7
Maryland	1897	29	19	11.4	79.1
	1898	31	22	10.4	76
	1899	6	18	10.2	74.6
	1900	1	10	9.3	74.2
Average for the four years		67	20	10.8	77.2
Massachusetts	1898	4	27	12	78.6
	1899	9	21	14.6	83.3
	1900	2	8	14	.....
Average for the three years		15	21	13.8	81.9
Michigan	1897	450	22	14.7	81.1
	1898	34	28	13.2	81.9
	1899	236	22	13.1	79.7
	1900	478	14	11.3	76.7
Average for the four years		1,198	19	13	79.1
Minnesota	1897	49	24	11	79.2
	1898	21	22	12.7	78.7
	1899	9	23	12.3	77.5
	1900	10	31	10.9	75.9
Average for the four years		89	24	11.5	78.5
Missouri	1897	324	20	11.7	73.5
	1898	43	17	8.5	68.6
	1899	19	17	7.1	64.3
	1900	9	15	8.5	67.2
Average for the four years		395	19	11.1	72.4
Montana	1897	4	20	14.4	77.8
	1898	7	21	11.2	72.6
	1899	2	40	10.7	70.6
	1900	4	38	10.4	69.8
Average for the four years		17	27	11.7	72.9
Nebraska	1897	13	29	12.9	76.9
	1898	10	25	12.8	76.8
	1899	6	19	11.3	74.4
	1900	11	28	9.9	72.1
Average for the four years		40	26	11.8	75.2
Nevada	1897	21	18	18.3	81.4
	1898	42	12	18.5	85.9
	1899	24	18	16.9	82.2
	1900	3	10	9.6	79.6
Average for the four years		90	15	17.7	83.7
New Hampshire	1898	2	34	13.5	83.5
	1899	4	17	15.5	86
	1900	9	29	11.1	74.9
Average for the three years		15	26	12.6	79.0

Average results of analyses of sugar beets for years 1897–1900, inclusive, by States—Cont'd.

States.	Year.	Number of samples.	Average weight.	Sugar in the beet.	Purity coefficient.
			Ounces.	*Per cent.*	
New Jersey	1897	31	16	14.2	81.4
	1898	33	20	11.1	77.5
	1899	17	27	11.3	77.3
	1900	2	20	11.4	76.7
Average for the four years		83	20	12.3	78.9
New Mexico Territory	1897	3	13	17.2	82
	1898	7	20	12.8	78
	1899	2	22	14.9	82.9
	1900	2	23	14.5	77.8
Average for the four years		14	19	14.3	79.5
New York	1897	225	21	15	82.4
	1898	328	21	12.6	80.5
	1899	142	19	13	78.8
	1900	51	22	13.3	79.8
Average for the four years		746	21	13.4	80.7
North Carolina	1897	7	23	9.1	75.3
	1898	14	19	6.5	61.8
	1899	2	17	7.6	69
	1900	4	23	10.3	76.4
Average for the four years		27	20	7.8	68.0
North Dakota	1897	4	28	10.5	.....
	1899	3	22	13.9	78.3
	1900	5	22	10.2	71.1
Average for the three years		12	24	11.2	73.8
Ohio	1897	68	22	13.8	79.1
	1898	409	24	11	77.1
	1899	128	24	11.9	76.1
	1900	64	26	10.3	73.1
Average for the four years		669	24	11.4	76.7
Oklahoma	1897	1	10	11.8	72.5
	1898	6	24	10.2	73.3
	1899	2	31	10.3	69.3
	1900	4	22	10.6	69.8
Average for the four years		13	23	10.5	71.5
Oregon	1898	6	20	14.1	83.4
	1899	1	17	15.8	84.3
	1900	11	19	12.4	78.9
Average for the three years		18	19	13.2	80.7
Pennsylvania	1897	59	18	13.8	79.5
	1898	81	21	11.6	78.1
	1899	28	31	11.2	75.4
	1900	11	21	10.6	74.8
Average for the four years		179	22	12.2	77.9
South Carolina	1897	13	17	9.9	79.9
	1898	4	14	10.2	81.2
	1899	4	14	13	79.3
	1900	3	29	8.4	69.5
Average for the four years		24	18	10.3	78.7
South Dakota	1897	5	17	15.1	83.2
	1898	24	16	13.9	78.6
	1899	11	25	10.6	72.8
	1900	9	29	10.5	71.7
Average for the four years		49	21	12.7	76.5
Tennessee	1897	17	11	10.8	71.9
	1898	10	17	8	69.3
	1899	2	54	8.3	67.6
	1900	1	15	5.4	54.8
Average for the four years		30	16	9.5	70.2

Average results of analyses of sugar beets for years 1897–1900, inclusive, by States—Cont'd.

States.	Year.	Number of samples.	Average weight.	Sugar in the beet.	Purity coefficient.
			Ounces.	*Per cent.*	
Texas	1897	11	22	12.6	76.5
	1898	49	25	9.5	69.8
	1899	3	12	7.5	53.7
	1900	15	29	6.9	56.8
Average for the four years		78	25	9.4	67.6
Utah	1897	35	20	14.3	81.1
	1898	14	16	13.6	85.3
	1899	10	20	15	83.6
	1900	5	14	13.8	81.3
Average for the four years		64	19	14.2	82.4
Vermont	1897	8	22	14.2	84.1
	1898	68	22	13.2	82.8
	1899	16	23	12.8	79.0
	1900	3	15	12.1	79.7
Average for the four years		95	22	13.2	82.2
Virginia	1897	34	21	11.6	76.2
	1898	43	20	8.9	72.4
	1899	6	17	9.5	74.2
	1900	49	18	10	74.1
Average for the four years		132	19	10	74.1
Washington	1897	34	27	13.7	80.7
	1898	5	27	13.9	81.3
	1899	8	23	13	77.8
	1900	2	24	14.9	85.6
Average for the four years		49	26	13.7	80.5
West Virginia	1897	14	19	15.4	80.4
	1898	4	28	9.1	72.9
	1899	3	20	9.1	67.2
	1900	4	7	10.7	62.7
Average for the four years		25	19	12.9	74.8
Wisconsin	1897	42	15	15.8	83.3
	1898	16	24	13	79.3
	1899	25	21	14.8	84.4
	1900	18	30	10	73.1
Average for the four years		101	21	14.1	81.1
Wyoming	1897	34	19	17.2	82.3
	1898	10	19	13.9	78.1
	1899	1	29	15.9	81.9
	1900	2	20	13.5	78.5
Average for the four years		47	19	16.3	81.2

ARKANSAS.

Fifteen samples have been examined during the four years from this State. The average percentage of sugar in the beet was 7.2, and the average coefficient of purity 63.2. It is evident that sugar can not be profitably made from sugar beets of this character.

CALIFORNIA.

The number of samples from this State was so small as to render the data of little value. The general results, however, confirm the opinion that the capabilities of growing sugar beets of high quality in the State are without question.

COLORADO.

During the four years 345 samples have been analyzed from Colorado. The percentage of sugar in the general average, viz, 13.8, is satisfactory, but the purity for the whole period, 78.2, is slightly below the standard.

CONNECTICUT.

The small number of samples which has been received from Connecticut renders an intelligent judgment, based upon the analyses, impracticable. These results show a character of beets which it would be quite unprofitable to attempt to turn into sugar. The climate and soil of Connecticut, however, are such as to lead to the supposition that beets of good manufacturing qualities could be produced in that State.

DELAWARE.

No valuable deduction can be drawn from the four samples which have been analyzed in three years from Delaware.

DISTRICT OF COLUMBIA.

The results of two years' work show very conclusively that the soil and climate of the District of Columbia are wholly unsuited to the production of beets of high quality for manufacturing purposes.

GEORGIA.

The analyses of fifteen samples from Georgia, extending over a period of three years, give some little indication of the capability of sugar-beet growing in the State. The results, except the one sample received in 1900, are not encouraging.

IDAHO.

Analyses of thirty-two samples from Idaho show the beets to be somewhat overgrown, with a satisfactory content of sugar and a purity slightly above the standard.

ILLINOIS.

One hundred samples have been received from Illinois during the four years mentioned. The average size of the beets was normal, but both the content of sugar and coefficient of purity were below the standard.

INDIANA.

Two hundred and thirty-five samples received from Indiana showed that this State has practically the same rank as a sugar-beet producer as Illinois.

Attention has already been called to the fact that in Indiana and Illinois a successful beet-sugar industry can be established only in the northern parts. It is not advisable to try to push the commercial growing of sugar beets further south than the central portions of these States.

INDIAN TERRITORY.

Samples have been received only one year from Indian Territory and the number is too small to serve as a basis for any rational deduction in regard to the quality of the beets in general grown in that Territory. Its location is such as to render any expectation of successful sugar-beet culture unsuitable.

IOWA.

Three hundred and eighty-three samples were received from Iowa, showing beets of good size and a fair content of sugar, just falling short of the average standard fixed for successful manufacture. The purity of the Iowa beets is remarkably low, when their content of sugar is considered. This fault can doubtless be remedied by more careful culture.

KANSAS.

The climate of Kansas, as has been repeatedly pointed out, is not suitable to the growing of high-grade sugar beets. The summers, as a rule, are too long and too dry. The data which have been secured from the one hundred and twelve samples received from that State confirm this statement.

KENTUCKY.

Twenty-three samples of beets grown in this State have been examined. Their uniformly low sugar content and purity are not encouraging.

LOUISIANA.

Only one sample from Louisiana enters into consideration here. This sample was small in size, but had a remarkably high content of sugar and purity. No conclusions respecting the capabilities of the State for sugar-beet culture can be drawn from this instance. It is interesting, however, to observe that a beet of such fine quality can be grown so far south.

MAINE.

Only two samples representing one year were received from Maine. These samples were remarkably poor in quality. It is interesting to observe that in the two States just cited the data obtained are contrary to the expectations which might justly have been entertained regarding the quality of the beets produced.

MARYLAND.

Maryland appears to be one of those States which is just on the border separating the good from the indifferent areas for sugar-beet production. There are many parts of Maryland where high-grade beets can be grown. This is especially true of the high plateau lands of the Allegheny Mountains. On the Atlantic seaboard, also, beets of high grade can be grown in Maryland. The sixty-seven samples secured from this State showed both the sugar content and purity below the standard fixed for successful culture.

MASSACHUSETTS.

The number of samples which have been received from Massachusetts—namely, fifteen—is too small to serve as a foundation for any definite conclusions. It is evident, however, where the soil conditions are favorable, that beets of high quality can be grown. The analytical data obtained from the Massachusetts samples are very satisfactory, both as regards sugar content and purity.

MICHIGAN.

In the case of Michigan, the number of samples received, viz, 1,198, was so large as to make the deductions therefrom very valuable. It will be seen that the beets were of good size, with a fair content of sugar and a purity almost reaching the standard.

There is little doubt of the fact that Michigan is one of the most favorable localities in the United States for the growing of high-grade sugar beets. When the farmers of the State thoroughly learn the art of successful beet culture, they will be able to compete even with the more favored districts of Europe, both in the quality of the beets produced and in the yield per acre.

MINNESOTA.

The data obtained from Minnesota are not so favorable as theoretical indications would lead one to expect. The analyses of eighty-nine samples indicate beets of very uniform and almost ideal size from the point of view of the farmer and the manufacturer. The content of sugar is slightly below the minimum standard, and the same remark can be applied to the purity coefficient.

MISSOURI.

Missouri, as in the case of Maryland, is one of the border States between the good and bad areas for successful beet culture.

The 395 samples received during the four years showed beets of good average size, with a fair content of sugar but a low purity. The

general result of the study of the data received from Missouri is distinctly unfavorable, and points to the fact that it is not a very suitable region for the successful growing of sugar beets.

MONTANA.

The results obtained from the few samples received from Montana indicate that in the beets grown there so far the percentage of sugar and the purity are very much below the average which might justly be expected.

NEBRASKA.

Many years of the commercial culture of the sugar beet have distinctly fixed the status of Nebraska in respect to this industry. The data obtained from this region show beets of fair sugar content but rather low purity. It has been demonstrated that beet sugar can be made in Nebraska, but it is evident from the data for the last few years that Nebraska does not rank as high as some of the other States in its capability of raising high-grade sugar beets.

NEVADA.

Although Nevada is not regarded as an agricultural State, it is evident from the data secured that if irrigation were practiced over considerable areas there is no State in the Union more favorable to the growing of high-grade beets. In fact, the data obtained from the ninety samples secured from that State are the most favorable of any obtained anywhere in the country. The remarkably high content of sugar in the beet, coupled with the high purity, more than offsets the rather small size of the beet produced. It is evident that in a State like Nevada, where intensive cultivation is essential, no crop could be produced so profitably as the sugar beet, provided the conditions of manufacture are favorable and the factories not too far removed from the sources of supply.

NEW HAMPSHIRE.

The few samples received from this State show beets of fairly high grade. It is not likely, however, owing to the contour of the State and the character of the soil, that beet culture will ever become an industry of great magnitude in that region.

NEW JERSEY.

Eighty-three samples have been received from the State of New Jersey. The size of the beets and the content of sugar were favorable with the purity almost up to the standard. It is evident that portions of New Jersey are favorable to the growing of beets which could be profitably used for sugar making.

NEW MEXICO.

Only a few samples were received from this Territory. The content of sugar in the beets from this region is high, and the purity almost up to the standard. In the commercial growing of sugar beets in this Territory difficulties have been met which have discouraged the growers to some extent, but it is believed that there are many areas in New Mexico where successful beet culture can be carried on.

NEW YORK.

Great interest has been manifested in the State of New York during the last few years in the sugar-beet industry, and three factories have been in operation. Both of the experiment stations, the one of Cornell University at Ithaca, and the State station at Geneva, have investigated the subject of beet culture and have secured data of a very valuable nature.

The data obtained here during the four years are also very favorable, especially so because based upon so large a number of samples, namely 746. While the content of sugar is not phenomenal, it is high enough to make a profitable yield, and the purity is satisfactory.

NORTH CAROLINA.

The samples received from this State showed beets of very poor quality. There are doubtless areas in the mountain regions where fine beets can be grown, but in the lowlands it is evident that the climatic conditions are unfavorable.

NORTH DAKOTA.

The small number of samples received from this State makes any deductions in regard to the beets grown there unreliable. The data, however, when considered with those obtained from the agricultural experiment station, show that successful beet culture can be practiced in North Dakota where the local conditions are favorable.

OHIO.

The large number of samples received from Ohio enables us to form a definite judgment in regard to the possibility of beet culture in that State. The same remark which has been made in regard to Illinois and Indiana is applicable to Ohio. The State as a whole can not be regarded as favorable to beet culture. There are, however, many places in the northern part where beets of high quality could be produced on a commercial scale.

OKLAHOMA.

The data from this Territory are distinctly unfavorable. The conditions which obtain there are very much the same as in Kansas, and the Territory is not suitable to the growth of high-grade sugar beets.

OREGON.

The data from the few samples received from this State are of little value when considered alone. When, however, those obtained from the agricultural experiment station are taken into account, it is evident that in Oregon, at least in certain portions of it, there are areas well suited to the production of beets of very high grade.

PENNSYLVANIA.

Pennsylvania does not hold as high a rank as New York or Michigan in sugar-beet production, but it is evident, from the data secured on 179 samples, that the beets are of a quality sufficiently high to insure favorable results from the manufacture of sugar from beets grown in that State. The great trouble seems to lie with the coefficient of purity. This, however, doubtless can be raised by careful culture.

SOUTH CAROLINA.

The data obtained from this State have been much more favorable than theoretical indications would lead one to suppose. The coefficient of purity in the South Carolina beets almost reaches the standard, while the content of sugar is not so much below the standard as might be expected. Nevertheless, it can not be said that South Carolina is among the number of those States where a successful sugar-beet industry can be established.

SOUTH DAKOTA.

The beets received from South Dakota had a fair content of sugar, but a low purity. It is evident that more careful culture must be practiced in order to raise the purity to the standard. When this is accomplished South Dakota can be considered as one of the localities favorable to beet production.

TENNESSEE.

There are many parts of Tennessee where the altitude is very great, but in these regions water is scarce and the land is devoted almost exclusively to grazing. In the parts of the State where agriculture is practiced it is evident that the conditions are unfavorable to the sugar-beet industry.

TEXAS.

Seventy-eight samples of beets have been received from Texas during the four years covered by the comparison. These beets were slightly above the average in size. They did not, however, show a content of sugar and purity coefficient which would encourage the hope of a successful beet-sugar industry in that locality.

UTAH.

The data from Utah show favorable conditions. In connection with these data, it must be taken into consideration that the sugar-beet industry has been established there on a successful commercial scale. This State can be regarded as one of the most favorable for beet production, and it is likely that a rapid expansion of the industry will be seen there in the near future. The coefficient of purity shows that often under irrigation beets can be produced which have a juice of the finest quality.

VERMONT.

The climatic conditions are favorable to the production of high-grade beets, as is clearly indicated by the data obtained from ninety-five samples. The contour of the State and the character of the soil, however, present difficulties in the way of the expansion of the sugar-beet industry which will be hard to overcome.

VIRGINIA.

The samples received from this State, 132 in number, are not encouraging to the belief that a successful beet-sugar industry can be established therein. There are doubtless many localities, especially in the mountainous regions, where exceptionally fine beets can be grown, but taken as a whole the State can not be regarded as among those where the future will see a successful beet-sugar industry established.

WASHINGTON.

Washington is in the same category as Oregon as a beet-sugar producing State. Perhaps the conditions as a whole are somewhat more favorable in Washington than in Oregon. The data obtained from the forty-nine samples show a high content of sugar and a purity slightly above the standard.

WEST VIRGINIA.

There are many localities in West Virginia, especially among the mountains, where beets of high quality can be produced.

The twenty-five samples received do not correctly represent the possibilities of the State. During the year 1897 there were fourteen sam-

ples received from West Virginia of exceptionally high character. A study of the data obtained during the other three years shows the beets to be of very inferior character.

The agricultural lands in the mountainous areas of the State, where the climatic conditions are favorable, are not extensive enough to allow any considerable development of the industry.

WISCONSIN.

The data obtained from Wisconsin showed that it is one of the favorable States of the Union for the growth of beets.

One hundred and one samples showed beets of ideal size, very high content of sugar, and purity above the standard.

WYOMING.

This State also contains many areas suited to beet culture. The forty-seven samples which have been secured show beets of exceptionally high sugar content and satisfactory purity.

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